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CONTENTS.

EDITORIALS:
High-Pressure Gas Lighting.....1009
The Enormous Coal Supply of the United States.....1010
Protection for the Motor.....1010
Dangerous Electrical Treatment.....1010
Electrification of the Denver and Rio Grande Railroad...1011
Advantages of Permanency in Technical Positions ..1011
DEPARTMENTS:
Commercial Practice 1020
Electrical Construction 1022
Among the Supply Men.....1029
Public Service Commissions.....1030
Questions and Answers.....1032
New Electrical and Mechanical Appliances.....1044
Current Electrical News.....1049
Record of Electrical Patents.....1055
LEADING ARTICLES:
Electricity in Knitting Mills.....1015
Ownership of Public Utilities.—By John B. Miller.....1021
Fire Alarm Systems.—IV.....1022
Commercial Tests of Lighting Transformers.—By V. M. Montsinger.....1026
Electrical Equipment of a German Theater.....1034
Electric Drive in Grand Rapids High Schools.....1037
Vertical Waterwheel Generators of a Novel Design.....1038
BOOK REVIEWS 1043
MISCELLANEOUS:
Meeting of Municipal Electricians in Philadelphia.....1012
Changes in Iowa Electrical Association.....1012
February Motor-Truck Show in Chicago.....1012
International Congress of Safety.....1012
French Wireless Girdle.....1012
University of Illinois Electrical Show.....1012
R. B. Owens.....1013
Meeting of the Electrical Credit Association of Chicago..1013
Oregon Contractors to Hold Meeting.....1014
Vast Coal Reserve in the United States.....1014
Census Report of Poles Purchased.....1014
Tool for Slotting Commutators.—By L. G. Frank.....1028
Among the Contractors.....1028
Aeroplanes Discussed by Chicago Electric Club.....1031
Some Considerations of Electric Supply.....1033
Electroculture in Germany.....1035
Commercial Aspects of Electrical Engineering.....1036
The Illumination of the Workshop.....1040
J. G. White & Company, Incorporated, to Organize Two New Corporations 1041
Tripling the Frequency.....1041
New Electric Power Stations for the Rand, South Africa.1041
Storage Batteries Discussed in Chicago.....1042
Electrification of Denver and Rio Grande.....1043

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HIGH-PRESSURE GAS LIGHTING.

An interesting report giving a comparison between high-pressure gas lighting and electric lighting by flaming arc lamps has recently been drawn up in connection with some experimental street-lighting installations in Manchester, England. Early last summer the City Council of Manchester, in order to decide the relative advantages of these two methods of street illumination, arranged for a joint investigation by Messrs. Haydn Harrison and Jacques Abady. A typical installation of each of the rival systems was arranged for the purpose.

A joint report has been made by the two investigators, accompanied by a separate additional report by each. The joint report states that the illumination provided by the two systems is approximately equal, but that the annual cost of the flaming arc lamps is less than that of the high-pressure gas lamps. As a comparison between the two systems, however, the results are vitiated by the fact that the gas lamps are not giving as high an efficiency as similar lamps should when properly installed and adjusted.

In the supplementary report by Mr. Harrison it is stated, however, that even had the gas lamps been working at double the actual efficiency, the electric lamps would still have been more economical. The cost of the electric lighting is 1.4 cents per hour for all-night lamps, energy being charged at the rate of 0.76 cent per kilowatt-hour. These lamps are connected eight in series across 400-volt mains and take 11 amperes.

The gas lamps were of the three-burner type and consumed about 80 cubic feet per hour at a pressure of 60 inches of water, inverted mantles being used. In Mr. Abady's report it is claimed that the efficiency of 27 candles per cubic foot could with suitable adjustment and pressure be raised to 50 candles and he recommends in future work two-burner lamps.

This trial comparison demonstrates the great superiority of the flaming arc lamp for street lighting under such conditions as obtain in this case, which are indeed in no way out of the ordinary. Owing to the use of many high-pressure gas lamps for street lighting, not only in England but in the cities of continental Europe, such as Berlin, it has been suggested by many persons that they must possess some advantage in cost or quality of service over electric lamps. As the cost of gas in Manchester was estimated at less than 30 cents per thousand cubic feet, it is

hardly to be supposed that the cost of maintenance would be less in any other place than it is there, and Manchester thus presents as favorable a case for gas lighting as could probably be found.

In the symposium on high-pressure gas lighting at the recent convention of the Illuminating Engineering Society, a great growth of this form of street lighting in Berlin, Germany, was pointed out. Between 1905 and 1911 only one additional mile of electric lighting was installed in that city, while 32 miles of high-pressure gas lighting were added. This suggested some superiority in the use of high-pressure gas in that city, but the report in question failed to state that in Berlin the gas is furnished by a municipally operated plant, whereas the electric central station in that city is operated by a private company. This is probably the secret of the development of street lighting in Berlin and explains why the use of electric lamps has not been more widely extended.

THE ENORMOUS COAL SUPPLY OF THE UNITED STATES.

In recent years there has been much doleful clamor by ultraconservationists respecting the dire distress in which this country would find itself if the great annual consumption and waste of its natural resources continued unchecked.

As to one of these resources a contrasting picture is presented by a recent statement of the United States Geological Survey which is reproduced on another page of this issue. It is shown that in the hundred years or so that coal has been mined in the United States there has been exhausted only one-half of one per cent of the country's available supply and that, if the consumption continues at the present annual rate, we have still a supply for about 4,000 years. This latter estimate makes allowance for the present great waste in our mining methods, one-half ton of coal being lost for every ton recovered. Nevertheless, the outlook, as presented by this reliable authority, is much more favorable than we have been led to believe.

Coal is one of the most important raw materials of our present civilization. Its utilization has made possible the tremendous progress that we usually attribute to steam. Despite the great development of hydroelectric energy, coal will continue for a long time to be the chief source of the world's power. It is gratifying, therefore, to know that we have several thousand years to develop other sources of power. When we think of the prodigious advance achieved in the last century of human history, the probability of further, even extraordinary, advances in the next few thousands of years should put at rest our fears. Meanwhile, there is room for true conservation of our coal and other resources through the prevention of wasteful methods of production and of utilization. However, the attempts to throttle development on the plea of conservation, particularly as to water-power resources, are manifestly puerile.

PROTECTION FOR THE MOTOR.

Not long ago a fire which proved to be a very disastrous one was started in a woodworking plant by the arcing at the brushes of a direct-current motor. In a report of the fire appearing in an insurance publication, it was stated that the plant owner felt that if induction motors instead of direct-current machines had been employed, there would not have been any fire, and that when the factory is rebuilt only motors of the former type will be installed. With this opinion concerning choice of motors for the kind of service mentioned, the publication referred to seems to agree.

In this connection one is inclined to wonder if such a report as the above is not somewhat unfair to the direct-current motor. Except in places where highly inflammable substances are present, there is but little danger of fire from the sparking of a motor of this type if the machine is properly cared for. The motor which started the fire in question was sparking badly, it is admitted, because it was being forced to carry an excessive load. It might very well have been admitted, too, that the motor circuit did not have proper fuse protection, for such protection would doubtless have opened the circuit before the arcing became bad enough to set fire to the plant.

The overfusing of motor circuits in industrial plants is an evil which is much too common, both where direct-current and where alternating-current motors are used, and those in charge of such plants can well afford to concern themselves with the matter of its prevention. Ignorant and irresponsible employees should not be permitted to tamper with cutouts or circuit-breakers installed to protect motors, and the motor selected for any given service should be of ample capacity to carry the maximum load liable to be thrown on it in the process of normal operation. Where the machine is not large enough to do this the temptation to overfuse it in order to prevent its stopping in the middle of some process or other which should be carried through without a hitch is frequently very great, and, withal, not unnatural. Efforts to economize either in time or initial cost by overfusing any type of electric motor is exceedingly poor practice.

DANGEROUS ELECTRICAL TREATMENT.

A recent accident which occurred in London illustrates the danger of using current from power mains for personal applications in electrotherapeutic treatment. An electric bath was being given to the victim of the accident, the arrangements being such that an incandescent lamp was connected between the 240-volt mains and the electrodes of the bath. The patient was immersed in water in a porcelain tub. It appears that the lamp was broken at the time the shock was received, and the accident is accounted for by supposing that the lamp terminals were short-circuited at the time, even though only momentarily. In that case the entire line voltage

would be applied to the bath and the patient would naturally experience the high voltage, with a large surface of the body in contact with the water, which would constitute the electrodes. Under such circumstances a fatal shock is to be expected.

The lesson to be drawn from such a catastrophe is that a voltage high enough to be fatal should never be used in apparatus intended for human application. In such cases the apparatus must be depended upon for protection in reducing the applied voltage to a safe figure, and apparatus, even though frequently inspected, should not be depended upon to such a degree. The risk involved in case of a fault is too great.

In the present instance there was no evidence of regular inspection by a competent person, and even though this element of protection were provided, the occurrence points to a faulty design of the equipment. Since it was intended to apply only 10 volts to the bath, a storage battery or other low-voltage source of current should be utilized. A voltage which might produce no harmful result when applied between the hands becomes dangerous when applied to a large surface of wet skin, and especially when applied in the vicinity of the heart.

ELECTRIFICATION OF THE DENVER & RIO GRANDE RAILROAD.

An important step in the gradual accomplishment of the electrification of trunk-line railroads is noted in the reported project to electrify the system of the Denver & Rio Grande Railroad. This railroad extends from Denver, Colo., across the Rocky Mountains, terminating at Ogden, Utah, with branches extending down into New Mexico. The main line skirts the eastern ridge of the Rockies from Denver to Pueblo, and then turns west across the continental divide. Its lines are largely among the mountains and it reaches an altitude which is only surpassed in this country by the more recently constructed line of the Denver, Northwestern & Pacific Railway, usually designated as the Moffatt Road. There are many difficult grades in the mountain divisions, and taken as a whole the road presents the very conditions which make electric propulsion desirable. The total mileage of the road is 2,529, of which 1,885 miles are of standard gauge.

It is proposed to begin the electrification on one of the western divisions, extending from Salt Lake City east over the first range of mountains. It is proposed to follow this with the equipment for electric power of the main line through to Denver.

The expressed determination of the officials of this road to complete the electrification of its main line in the near future will be of great interest to electrical engineers, as the equipment of an extent of 750 miles of road will be the largest experiment of this kind which has yet been undertaken in this country, and the results of this operation will be the most conclusive demonstration of the possibilities of electric operation on trunk-line railroads. The technical details of this project have not as yet been announced, but it is probable that a three-phase system will be adopted.

It is of interest also to note that the railroad does not contemplate the erection of any generating station, but will purchase current from the power companies operating in the territory traversed.

ADVANTAGES OF PERMANENCY IN TECHNICAL POSITIONS.

This is a day of specialization, and modern progress along technical and industrial lines is in no small measure due to that important fact. While a man who is not a specialist at a given sort of work may do it after a fashion, there are few jobs so simple that it is not best to have them done by the specialist whenever it is possible. In any case, this means economy of time, at least; in electrical work it counts also for safety and for everything else which makes for a maximum of efficiency.

The correctness of these statements is so obvious that remarks of this kind are quite liable to appear commonplace and unnecessary. Nevertheless, it is true that in some branches of the electrical field there is very great need for a keener and more general appreciation of the fact insisted upon here. Witness, for example, the frequent changes in the employees of municipal electrical departments and municipally operated central stations in many of the towns and smaller cities of the country. In the case of such departments, it is altogether too often true that a political zeal for the benefit of the party that happens to be in the ascendant locally is powerfully effective in the matter of securing and holding a position, if, indeed, it is not an indispensable qualification. Even where control by civil-service boards is supposed to govern, there is not always perfect immunity from such conditions.

How unfortunate these conditions are, need not be further commented upon. Though the possession of one of these accomplishments is not proof of any lack of the other, there is certainly a great difference between technical knowledge or professional experience and the ability to manipulate ward politics. The sooner this is learned in any municipality the better.

It is where this has been learned and the knowledge applied that one finds the municipal electrical bureau really proficient and its work effective. A large city is recalled now in whose electrical inspection and fire-alarm bureaus there are many men who have served continuously for periods ranging from 10 to 25 years, these men having been promoted step by step from one position to another as they have become more and more expert in the service; and there is perhaps none in the country better known than this electrical department for high-grade service. This is one of the best possible ways of insuring the sort of service that the public has a right to expect.

Meeting of Municipal Electricians in Philadelphia.

On Monday, December 9, 1912, the Philadelphia Section, American Institutes of Electrical Engineers will hold a "Municipal Night," at the Engineers Club, 1317 Spruce Street, Philadelphia. The subject for discussion will be "Electrical Methods Used by Fire and Police Departments in Municipalities." The discussion will be opened with papers by John W. Kelly, Jr., president of the International Association of Municipal Electricians, Clayton W. Pike, chief of electrical bureau, Philadelphia, and Washington Devereux, chief electrical inspector of the Philadelphia Board of Fire Underwriters. The papers will be discussed by James B. Yeakle, superintendent of fire alarm, Baltimore, C. I. Diehl, superintendent of fire and police telegraph, Harrisburg, Leo P. Firman, electrical bureau, Philadelphia, and others.

An informal meeting of the International Association of Municipal Electricians will be held the same day at 10 a. m. at the Electrical Bureau, City Hall, Philadelphia, Pa. The purpose of this meeting is for discussion of plans for the advancement of the interests of the Association.

A cordial invitation to attend this meeting is extended to all Municipal Electricians and others interested in these vital subjects.

Changes in Iowa Electrical Association.

At a meeting of the Executive Committee of the Iowa Electrical Association, held in Koekuk, Ia., on November 15, W. H. Thomson, Jr., manager of the Des Moines Electric Company, was elected president of the Association to fill the vacancy occasioned by the resignation of Paul B. Sawyer, formerly of Dubuque. At the same meeting H. B. Maynard, secretary of the Citizens' Gas & Electric Company of Waterloo, was elected secretary of the Association to fill the vacancy occasioned by the resignation of A. W. Zahm of Mason City, who is leaving the Iowa field to assume the management of the Minneapolis Electric Equipment Company, at Minneapolis, Minn.

During the afternoon the members of the Executive Committee were the guests of the Mississippi River Power Company, the Stone & Webster Company and the Hydraulic Engineering Company of Maine, the afternoon being spent in looking over the power house and dam which these companies are now erecting and which are nearing completion.

The dates for the next annual convention are April 23 and 24, at Waterloo.

February Motor-Truck Show in Chicago.

The annual national exhibition of commercial motor vehicles will be held in Chicago from February 10 to 15, 1913, occupying the second week of the Thirteenth Annual National Automobile Show. The display will be larger and more diversified than ever, filling all of the floor space in the Coliseum Building, Coliseum Annex, and First Regiment Armory.

Sixty-five motor truck and delivery wagon companies have already contracted for space, and there is a waiting list of belated applicants. The otal number of complete-vehicle exhibitors will be about 90. Manufacturers have reserved larger spaces this year than last winter and will display more models. Most of them have extended their lines by adding new models of different load capacity, while some companies that heretofore have confined their attention exclusively to gasoline vehicles will exhibit new el ctric models and others that have produced only electric vehicles will show them side by side with gasoline trucks that they have brought out.

In all there will be on exhibition about 250 different models of motor vehicles suited to every kind of industrial, commercial, municipal and governmental purpose. So many of these are entirely new designs that they will embody the latest improvements in every detail whereby the efficiency, reliability, durability, accessibility and general ability of the power vehicle is increased. There will also be displays of parts, equipment and supplies by nearly 200 accessory manufacturers.

The Chicago show is held under the auspices and support of the National Association of Automobile Manufacturers. Each winter the show is the largest and most representative exhibition of its kind in the United States, open to all manufacturers on equal terms.

Illinois Students Make Inspection Trip.

The students of the department of electrical engineering of the University of Illinois made their annual inspection trip this week. Leaving Urbana on Sunday evening the party first went to Keokuk, Iowa, to inspect the mammoth hydroelectric development at that place. The party then travelled to Chicago, where the works of the Western Electric Company, the power plants of the Commonwealth Edison Company, the works of the Illinois Steel Company at South Chicago, the factory of Automatic Telephone Company in Chicago, and the retail store of Marshall Field & Company were visited.

International Congress of Safety.

An international congress to discuss life-saving methods and the prevention of accidents will be held from September 9 to September 13, 1913, in Vienna, Austria. The work of the congress will be divided into ten divisions: (1) First medical aid in accidents; (2) training of the laity in first aid to the injured; (3) life-saving in cities and in the flat country; (4) life-saving in transportation by railroads, automobiles and aerial craft; (5) life-saving on the sea and other bodies of water; (6) life-saving in mining and allied industries; (7) life-saving by fire departments; (8) saving on mountains; (9) life-saving in sports; (10) prevention of accidents.

New York Railway Parade.

To show the progress that has been made in the street-railway facilities, the New York Railways Company had a parade on November 21. The procession was headed by a small horse car of the type used in 1860 pulled by a single horse, although two horses were used for the purpose in the parade. This was followed by a cable car, a pay-as-you-enter car, a low-step middle-door car, and finally a double-deck car which has been running during the present season on Broadway.

Aboard this car were Public Service Commissioners Wilcox, Eustis and Williams, and Theodore P. Shonts, Frank Hedley, D. W. Ross and Alfred Craven, officers of the company.

French Wireless Girdle.

The French Government has decided to establish a series of wireless stations, connecting Paris with the various French colonies and with North and South America. The project as laid before the chamber contemplates the expenditure of $4,000,000 in 1913. The point of connection with North America has not yet been specified, but in the South American-Pacific girdle includes stations in Morocco, the Islands of St. Louis, Martinique, the Marquesas Islands, Tahiti, Noumea, capital of New Caledonia and thence to Saigon, Indo-China.

University of Illinois Electrical Show.

The custom of holding a triennial electrical show at the University of Illinois will be continued and the next show is to be held on February 6, 7 and 8, 1913. It will be held in the electrical laboratory of the University at Urbana, Ill., and will be given under the auspices of the Electrical Engineering Society. The show as usual will be conducted by undergraduate students. Electrical and manufacturing companies will be allowed to exhibit. D. C. Wood is the general manager of the show.

R. B. Owens.

It is seldom that there is possessed by a single individual so rare a combination of scholarly attainment, wide experience and wholesome personality as distinguish the subject of this sketch, R. B. Owens.

Robert Bowie Owens is a southerner, a native of Maryland, where he was born in 1870. His early education was obtained at the Charlotte Hall Military School, Maryland, where he was graduated in 1886. He entered the works of the Baxter Motor Company at Baltimore, and was engineer of its New York office in 1887. In this year he became a special student in physics, mathematics and electrical engineering at the Johns Hopkins University under Professor Rowland and Dr. Louis Duncan. After two years at Hopkins he spent another year with the Excelsior Electric Company of Brooklyn, and then devoted himself to central-station erection and operation. Still retaining the management of a central lighting plant, in the autumn of 1890, he entered the graduate course in electrical engineering then being offered by Columbia University, New York, and received from the School of Mines the graduate degree of electrical engineer in June, 1891, his being the first class to receive the degree in America.

In the autumn of 1891 he was appointed to the professorship of electrical and steam engineering at the University of Nebraska, retaining this position until 1898, when he resigned to become professor of electrical engineering at McGill University, Montreal.

In 1893 he was made a member of the International Electrical Congress meeting in Chicago and a member of the International Jury of Awards for the Columbian Exposition. In 1898 he was director of the electricity and machinery building of the Trans-Mississippi Exposition, receiving a special diploma and gold medal for his services. At the time of his going to McGill he was appointed to the John Tyndall fellowship for the encouragement of physical research, Columbia University, and twice reappointed. In June, 1899, he received from the Faculty of Pure Science, Columbia, the degree of M.A. in connection with his discovery of the emanation from the rare earths, a discovery upon which most of the later work on the ultimate constitution of matter has been based. He completely remodeled the methods of engineering teaching at McGill, and from this institution received the degrees of B. Sc. (ad eundem) M. Sc. and D. Sc. In 1903 he was made a Fellow of the Royal Society of Canada. In 1904 he was a member of the International Electrical Congress of St. Louis, and a member of the International Jury of Awards for the Louisiana Purchase Exposition. He left McGill in 1909, and in 1909-1910 was electrical engineer for the Southern Power Company of Charlotte, N. C.

He left the Southern Power Company to become secretary of the Franklin Institute of Philadelphia, Pa., where he has labored with great success and greatly increased the scope and possibilities of the institution. His work here has been of the same high order as has characterized his former endeavors, and he has the warm support of everyone interested in the development of the Franklin Institute. Since the comparatively recent accession of Dr. Owens to the secretaryship, the interests and activities of the Institute have greatly expanded. The enrollment of pupils has increased very materially, the lectures have been continued with the ablest workers in technical and practical scientific fields, and the contributions to the journal of the Institute have made it of even greater value and increased its prestige over anything that has been attained heretofore.

Robert B. Owens,
Secretary of the Franklin Institute.

Dr. Owens is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Institution of Electrical Engineers of Great Britain, a member and past-president of the Electrical Section of the Canadian Society of Civil Engineers, a member of the Society for the Promotion of Engineering Education, a Fellow of the Royal Society of Canada, and a member of the Lotos Club of New York; Cricket Club, Philadelphia; Cosmos Club, Washington, D. C.; and Annapolitan Club, Annapolis, Md.

Meeting of Electrical Credit Men.

The seventeenth annual meeting of the Electrical Credit Association of Chicago was held at the Chicago Athletic Club on November 22.

The afternoon meeting was devoted to a discussion of numerous questions relating to credits and similar subjects. Officers were elected for the ensuing year as follows: President, S. E. Kennedy, Central Electric Company; vice-president, A. O. Kuehmsted, Gregory Electric Company; national representative, James Wolff, New York Insulated Wire Company; secretary-treasurer, Frederic P. Vose, Chicago, Ill.; members of the Executive Committee: 1913—E. R. Gilmore, Western Electric Company; R. M. McConnell, Westinghouse Electric & Manufacturing Company. 1914—W. A. Browne, M. B. Austin & Company; Charles E. Ummach, Ummach Manufacturing Company. 1915—Thomas I. Stacey, Electric Appliance Company; A. O. Kuehmsted, Gregory Electric Company.

The annual dinner was begun promptly at 6:30 p. m., and this brought out a record attendance, some 150 members and their guests being seated. The program included a scholarly address by Harold Almert, manager of the department of examinations and reports of H. M. Byllesby & Company, Chicago, entitled, "Public Relations and Public Utilities"; an address by William C. Sprague, of Detroit, entitled, "The Law and the Profits"; an address by Emil G. Hirsch, entitled, "Capital, Capacity and Character," and a fund of entertainment of a lighter sort by William Lightfoot Visscher. The music was supplied by Nadel's orchestra and the vocal entertainment was contributed by the Oxford Quartette.

Oregon Contractors to Hold Meeting.

The annual convention of the Oregon Electrical Contractors' Association will be held on December 17 and 18 at Portland, Ore. The headquarters will be at Moose Hall, Seventh and Morrison Streets. This will be the first meeting of the Oregon association, which is a branch of the national association.

The following program of papers has been arranged: "The Relation of the Electrical Jobber to the Electrical Contractor," by F. N. Averill, of Portland; "What the National Electrical Contractors' Association is Doing for the Electrical Contractor," by Geroge H. Duffield; "Some Practical Statements from a Central-Station Expert," by O. B. Coldwell, of the Portland Railway, Light & Power Company; "Municipal Inspection," by Howard Joslyn, city electrician of Seattle; "Credit—Its Utility in the Modern Commercial World," by L. B. Smith, Portland; and "Costs and Efficiency," by P. L. Proctor, manager of Pacific Audit Company.

A theater party will be held in the evening of December 17, and on the following day a trip is planned to the power plant of the Portland Railway, Light & Power Company. An entertainment and banquet will be given in the evening.

Vast Coal Reserve in the United States.

The known coal fields of the United States embrace a total area, according to the United States Geological Survey, of 310,296 square miles, to which may be added something over 160,000 square miles of which little is known, but which may contain workable coals, and about 32,000 square miles where the coal lies under heavy cover and is not considered available under present conditions. The supply of coal before mining began is estimated to have been 3,076,204,000,000 short tons, of which 1,922,979,000,000 tons were considered to be easily accessible and 1,153,225,000,000 short tons to be either so deep or the beds so thin that they are accessible only with difficulty. Classified according to the character of the coal, the original supply consisted of 21,000,000,000 short tons of anthracite, 1,661,457,000,000 tons of bituminous coal, 650,000,000,000 tons of subbituminous coal, and 743,590,000,000 tons of lignite, the supply of bituminous coal being something more than that of all other grades combined.

The total production of coal to the close of 1911 has amounted to 2,270,798,737 short tons of anthracite and 6,468,773,690 tons of bituminous coal, or an aggregate of 8,739,572,427 tons. This total production to the close of 1911 represents, including the waste of coal in mining, an exhaustion of the beds equal to 14,181,980,000 short tons, or somewhat less than 0.5 per cent of the original supply. In other words, the quantity of coal still remaining to be mined amounts to 3,062,022,020,000 short tons, or a little more than 99.5 per cent of the original supply. The annual rate of exhaustion at the present time as represented by the production in 1910 and 1911, is 0.025 per cent of the supply. The quantity of coal still in the ground at the close of 1910 was 6,000 times the production of that year, or, estimating a half ton of coal lost for every ton recovered, the supply is equivalent to 4,000 times the present annual rate of exhaustion.

In another recent statement issued by the Geological Survey it is shown that coal was first discovered in the United States near Ottawa, Ill., about 1679. The first actual mining of coal was in the Richmond Basin, Va., about 1750. The real mining of American coal on any considerable scale dates back only about 100 years, however.

Census Report of Poles Purchased.

A preliminary statement showing the number of poles purchased by the telephone and telegraph, steam and electric railroad, and electric light and power companies in the United States during the years 1911, 1910, 1909, 1908, and 1907 have been issued by Director E. Dana Durand of the Bureau of the Census. The report was prepared under the direction of William M. Steuart, chief statistician for manufactures, by Jasper E. Welchel. The data were collected in co-operation with the Forest Service, and form one of a series of annual reports regarding the lumber and timber industries.

While the total purchases of poles in 1911 was less than those for 1910 and 1909 by 452,674 and 320,720 respectively, it exceeded the totals for 1908 and 1907 by 168,866 and 134,752 respectively. The decrease in the 1911 totals as compared with that for the preceding year was confined entirely to a falling off in purchases by telephone and telegraph companies and steam railroads, while a substantial increase in purchases was made by electric railroads and electric light and power companies. The decrease in 1911 in purchases reported by the telephone and telegraph companies was not general, being confined in the main to states in which there was more than usual activity in the construction of telephone lines during 1910.

Of the total reported purchases in 1911, 2,402,724 or 70.3 per cent were made by the telephone and telegraph companies; 787,649 or 23.0 per cent by the electric railroad, light and power companies, and 227,647 or 6.7 per cent by the steam railroads.

During the five-year period covered by the report, the total purchase of poles was 17,539,876, of which cedar contributed 11,281,152, or 64.2 per cent; chestnut, 3,125,403, or 17.8 per cent; oak, 938,874, or 5.3 per cent; pine, 798,662, or 4.5 per cent, and cypress, 417,087, or 2.4 per cent. While these five varieties of wood have led in supplying pole material during each of the five years covered, having furnished 94.3 per cent of the total, the tendency which has been noted for several years to substitute less expensive woods for most of them continued during 1911. With a decrease in the number of poles reported from all woods in 1911 as compared with 1910 of only 11.7 per cent, the loss in cedar was 13.6 per cent; in oak, 24.8 per cent; in pine, 12.4 per cent, and in cypress, 3.3 per cent. A slight gain, however, was made by chestnut, of 2.4 per cent. Of the seven other woods separately shown in the subjoined statement nearly all of the poles cut from redwood, tamarack, osage orange, and locust were reported by telephone companies. In all, 35 different species of timber contributed to the total pole purchases in 1911.

During 1911 there were 656,504 poles reported as having been given some kind of preservative treatment. This number exceeded the total for 1907 by 260,305, that for 1908 by 312,116, and that for 1909 by 79,873, but was less than the number reported as having been treated in 1910 by 168,169. The principal woods treated in 1911 were cedar, yellow pine and chestnut, while smaller though important percentages are also shown for juniper, oak, cypress, Douglas fir, and western pine.

The accompanying table shows by varieties of wood, the number of poles purchased in each year from 1907 to 1911 inclusive:

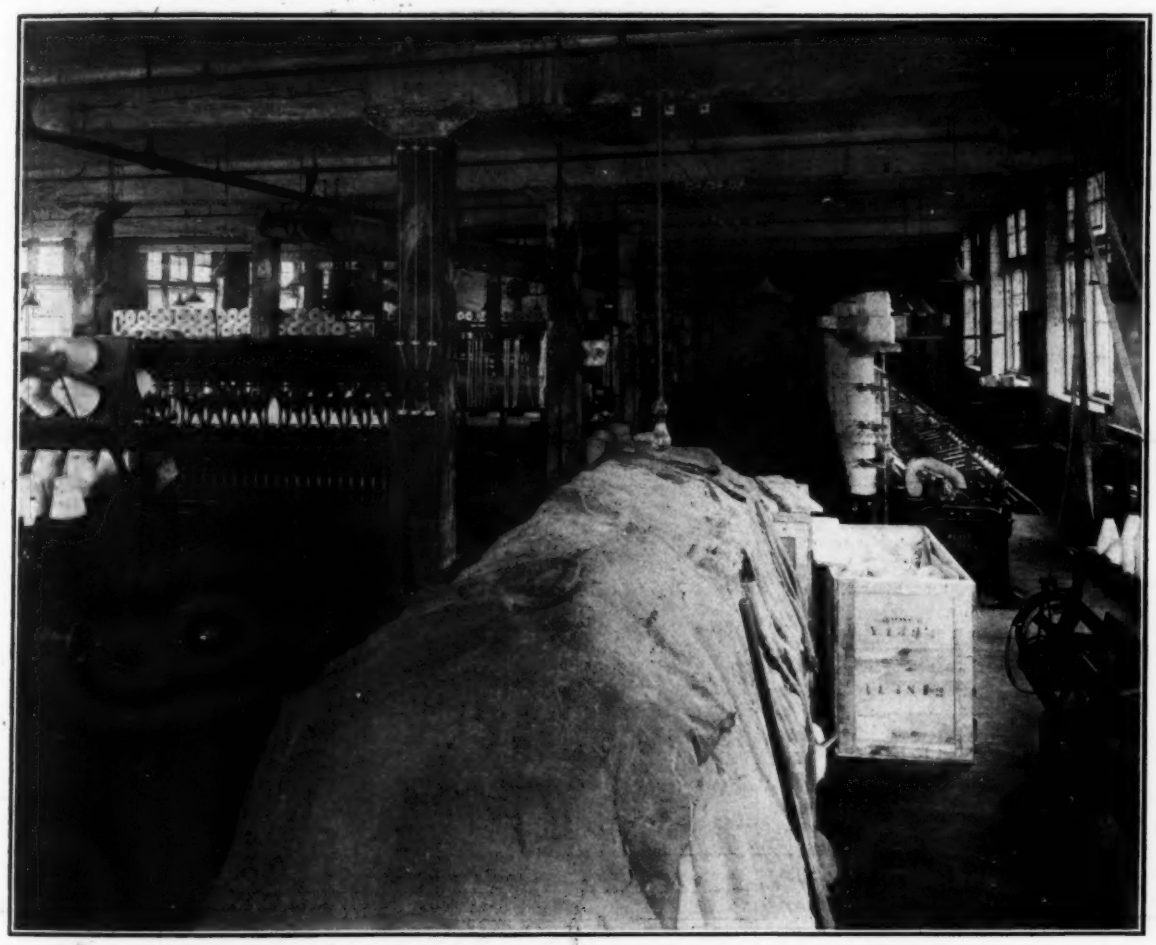
Kind of Wood	1911	1910	1909	1908	1907
Cedar	2,100,144	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	693,498	677,517	608,066	516,049	630,282
Oak	199,590	265,290	236,842	160,702	76,450
Pine	161,690	184,677	179,586	116,749	155,960
Cypress	72,995	75,459	77,677	90,579	100,368
Juniper	27,847	20,042	43,581	42,367	38,925
Redwood	26,887	30,421	23,145	13,061	31,469
Douglas fir	24,833	56,732	24,877	19,542	15,919
Tamarack	23,543	30,964	29,889	24,123	13,884
Osage orange	21,101	23,221	21,491	18,109	5,962
Spruce	10,166	22,929	11,423	8,088	10,646
Locust	8,477	9,030	10,463	10,224	4,672
All other	47,258	42,845	31,875	29,422	89,254
Total	3,418,020	3,870,694	3,738,740	3,249,154	3,283,268

Electricity in Knitting Mills.

Electric motor drive is particularly suited to needs of knitting mills for operating knitting machines, winders, dryers, presses, etc. Constant speed, uniform drive, more light in mill, no loss of power are only a few of the many advantages discussed that apply specifically to such plants. Pertinent illustrations of these advantages together with operating data on a number of installations are given in this article.

Knitting is one of the many branches of the textile industry which is rapidly developing an appreciation of the benefits of electric motor drive, as is evidenced by the number of new mills which are being laid out for electric service and of old mills being changed over from their former equipment. It is equally true that in knitting mills there can be no question as to the economies and benefits of central-station service.

Generally speaking, knitting mills may be classified under two heads, (1) mills spinning their own yarn; and (2) mills buying yarn and confining their operations to knitting processes only. This article will deal particularly with plants coming under the latter classification, as the greatest majority of establishments purchase yarn. The operations involved in spinning will, therefore, be only briefly discussed, a subsequent article being assigned to cotton mills.



General View in Hosiery Mill Showing Absence of Overhead Belts and Shafts.

Specific Advantages of Motor Drive.

One of the first items to consider in treating of the advantages of electric motor drive that apply specifically to knitting mills is the location. In locating steam-driven power plants if full consideration is given coal, and ash handling, condensing water, etc., manufacturing conditions are usually sacrificed. Mechanical drives from water wheels often make it necessary to locate a mill on soft ground near a waterfall where an expensive concrete foundation is necessary under the entire building. Although line shafting may be perfectly alined when first installed in such a building, the slow settling of parts of the mill will move the hangers out of line. This will greatly increase the shaft friction and cause a condition for power waste which, unknown to the management, is reducing production in many mills today.

With electric drive mills may be located not only where manufacturing conditions are best but also where cheap foundations are sufficient. The buildings need not be made as sturdy as vibration is practically eliminated. Also the mill with its drive can be constructed without reference to future extensions which can be easily made without disturbing the buildings already completed. This is not the case where mechanical drives are used as

belt towers, engine capacities and power-transmission problems make alterations in a completed building necessary before extensions can be made. The wasteful practice of installing part of a compound engine is unnecessary when electric drive is used.

The foregoing advantages apply to new mills. In existing plants the routing of material and the necessary light can be determining factors of location where machines are not rigidly located for convenience of mechanical drive. Corners which could not be used with mechanical drives become productive with individual motor or small group drives. These advantages result in more production and less wastage, conditions which are necessary for success in these days of curtailment and competition.

A reciprocating steam engine seems to give a steady speed when a speed indicator of the usual type is applied to its shaft. The rapid variations in angular velocity due to the change from linear to rotating motion, while too rapid to be seen, are usually great enough to cause wastage and to unduly shorten the useful life of knitting-mill machinery.

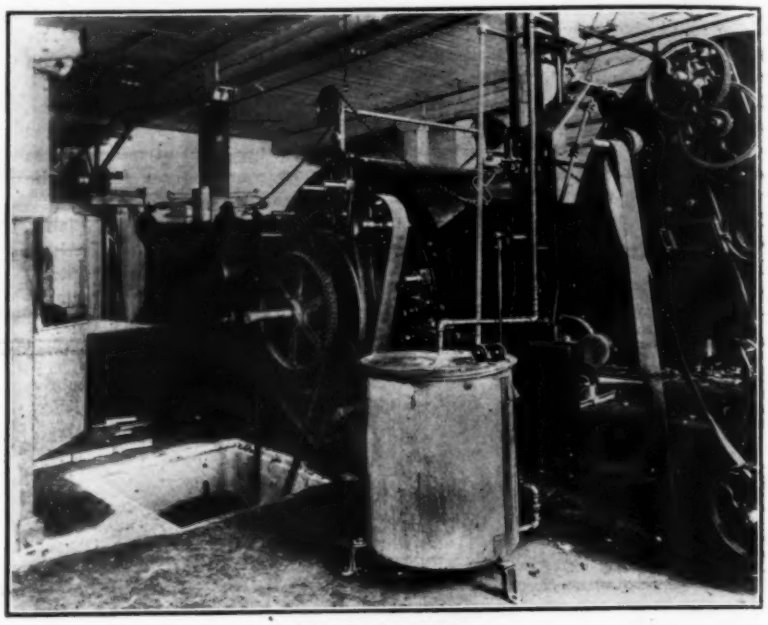
A long shaft driven by reciprocating engines often shows 10 per cent speed variation at the end farthest from the prime mover. This variation is caused by the initial unsteadiness of the prime mover, accentuated by the slipping and crowning of belts partly due to glazed spots and by the jerks of the machines themselves.

The steadiness of electric drive with their constant angular velocity, increases the useful life of the driven machinery and greatly reduces wastage. One mill which produces 60 miles of woven goods per hour, largely by electric drives, has found this reduction in wastage to be 10 per cent.

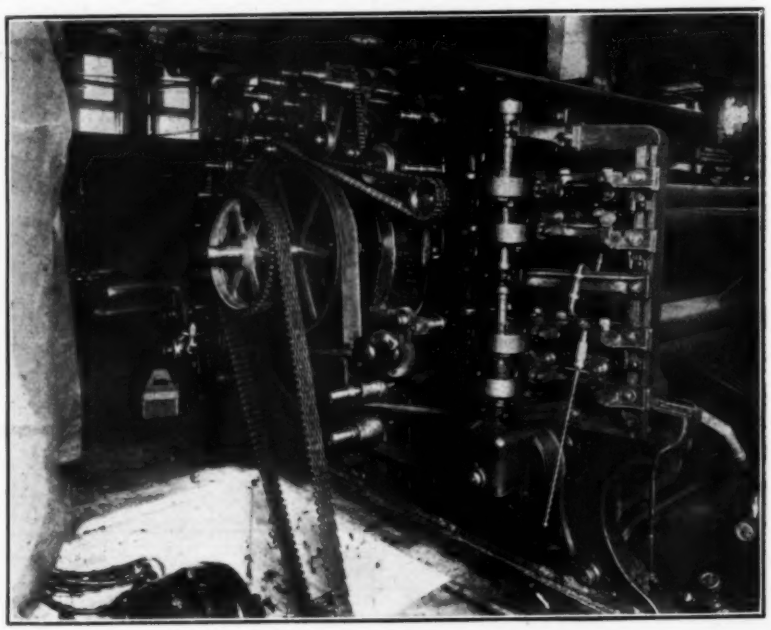
The slipping of belts between engine and driven machine frequently result in 10 to 20 per cent loss of speed in the latter. With group electric drive the number of belts and shafts is greatly reduced, while with individual-motor drive they are entirely eliminated and each machine is kept up to its maximum productive speed at all times.

Mill machinery may be driven with individual motors, or in groups largely selected with reference to overtime operation. Only the machines actually wanted need be operated overtime. No long line shafts with their attendant power loss need be operated. No oilers need be paid overtime to watch bearings.

Another important item to consider in connection with electric motor drive is the reduction in fire risk. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If the central-station power is used, all danger from adjoining power plant is removed: in any case, electric drive not only does away with the inflammable dust inevitably carried into the engine room by the large belt, but also makes possible the complete isolation of engine and boiler either by means of solid fireproof walls or by their installation in a separate building. The elimination of heavy line shafts greatly reduces the danger of fire from overheated journal boxes or from spontaneous combustion of accumulated oily waste. It should be remembered that the rate charged by insurance companies, especially where steam boilers are in close proximity to the working machines, is exceedingly high, and that by installing complete electrical equipment in a modern fireproof building the annual premiums may be reduced from perhaps 7 or 8 per cent to three-quarters or one per cent. In many cases the savings in premiums will go far in making up for



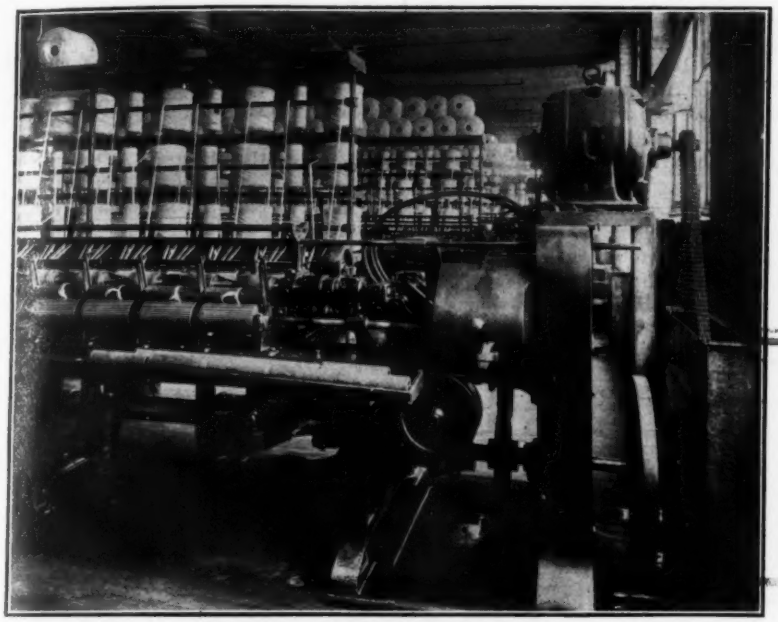
Motor Driving Picker.



Motor Drive in Rockford Mill.

the original cost of the electric installation.

Fewer bearings, which can be arranged for easy inspection, also tend to reduce the risk. Portable power indicators will tell at a glance if each machine is running freely in its bearings. Impending hot bearings are thus quickly and easily foretold before the fire risk becomes dangerous. This chart also indicates the operative's attention to his work.



Typical Motor Drive in Hosiery Mill.

The elimination of flapping belts reduces the dust flying around in the air and thus minimizes the risk of dust explosion. The ability to stop shafting promptly, in case of an accident to an operative where motors are employed, is by no means unimportant, while increased light and cleanliness due to elimination of overhead belts and bearings is a very great advantage where the fabric is valuable.

Individual-Motor-Driven Machines in a Large Hosiery Mill.

Application of Motors to Knitting Machines.

There are three common methods of applying the electric motor to knitting machines, the choice of which must be largely determined by local conditions. In some cases each room or division of the factory may be driven by a single motor retaining the old shafts and belts. This offers an easy solution to the problem of converting an old mill to electric drive. Since each floor or department is, by this means, operated as a unit, production may be regulated to good advantage.

The second method is to sub-divide the floors into groups driven by motors of from one to ten horsepower depending on the size of the cylinders and the number of machines in each section. These divisions are very natural ones as a rule since for hosiery and underwear sleevers from 10 to 50 machines are usually connected by light belts to a common shaft mounted on the floor or ceiling and for heavy underwear machines with cylinder from 12 to 28 inches two or more are mounted on a table with a common shaft. It is a simple matter to connect the motor directly to this shaft; gears, chains or belts are used to transmit the power, the choice between the three being a matter of individual preference as each has certain advantages. In using steel or cast-iron gears it is well to use a pitch-line speed less than 1,100 feet per minute on account of the vibration and noise attendant on high-speed operation.

The third method is to place a motor of fractional horsepower on each machine. In reality this is the ideal method, as each machine is independent of every other, and all the advantages of the small group are further accentuated. As in other industries, individual drive is the latest development and productive of the best results.

Any of the three methods discussed is of course applicable to the drive of ribbers or circular knitting machines if the motor be properly selected for the work to be done.

On of the chief troubles experienced with knit goods consists of small holes or "birds-eyes" which are generally attributed to the derangement of the setting of the dial, tucking or other cam. After the cams have been properly adjusted they may be displaced by jaring or jerking of the machine, which will cause the work to run badly. A slipping belt is a splendid means for throwing the cams out of adjustment.

The breakage of needles is dependent to a certain degree upon the condition and quality of the yarn, but a regular speed will undoubtedly increase the chances of the needle to care for uneven yarns whether using spring or latch needles. In one small mill a saving of $2.00 a day has been realized in the breakage of needles alone since the installation of motor drive, using exactly the same kind of yarn as before.

While a small item, yet the care of needles is one of the details that go to make profits for the business.

Individual drive has been extensively applied on full-fashioned hosiery machines, both of domestic and foreign make. The value of the machine and product here makes it imperative that the drive be absolutely regular to increase the life of the machines and the quality of the stockings.

A device which is sometimes used on a legger is to have the machine operate slower when knitting on the heel than on the welt or leg of the stocking. In one mill a speed of 45 courses per minute is used on the leg and 35 courses per minute on the heel by changing the motor speed from 1,120 to 850 revolutions per minute. The user claims better work on this account since more power is required to knit the reinforced heel than the rest of the stocking. A test on a legger driven as above showed that one-half again as much power was required on the heel.

Some hosiery manufacturers claim that, due to the more regular speed of the individually driven frames, they may be speeded up several courses faster than if belt driven. This is very desirable if it can be done without detriment to the work, as the increase production is a direct increase on the profits of the business. All these motors may be equipped with oil switches so that they may be started and stopped from the shipper handle. Thus the knitter is not required to perform any new operations.

Pickers. Pickers should be located in a room surrounded with fire walls having self closing steel doors and fitted with fire hose and automatic sprinkler system. Relative to the machines, the opener with its auto-apron feed and three-bladed beater running at 1,000 revolutions per minute, the breaker pickers with their two-bladed beaters running at 1,100 revolutions per minute, the intermediates with their two-bladed steel beaters and the finisher pickers with their three-bladed pin beaters are all best driven by individual motors suspended from the ceiling. The motors are thus out of danger from broom handles in the hands of careless operatives. All the benefits due to sub-division of power, localizing shut downs and eliminating line-shaft friction are realized with this drive.

Belt maintenance is a considerable item with this drive and maximum production is just out of reach due to belt slippage. Motor starting boxes should be placed on side walls nearby. Some pickers are driven by motors placed under the apron and some by motors placed on "A" bracket attached above the picker frame. These drives are open to objections mentioned and the motors are liable to be damaged by carelessness on the part of operatives.

The direct-connected individual-motor picker drive, with rotating part of motor on extension of beater shaft gives maximum production, since all slipping is eliminated and it does away with the cost of belt maintenance. In this drive the motor frame is attached by a bracket to picker frame and the rotating part has no bearings other than those of the beater shaft.

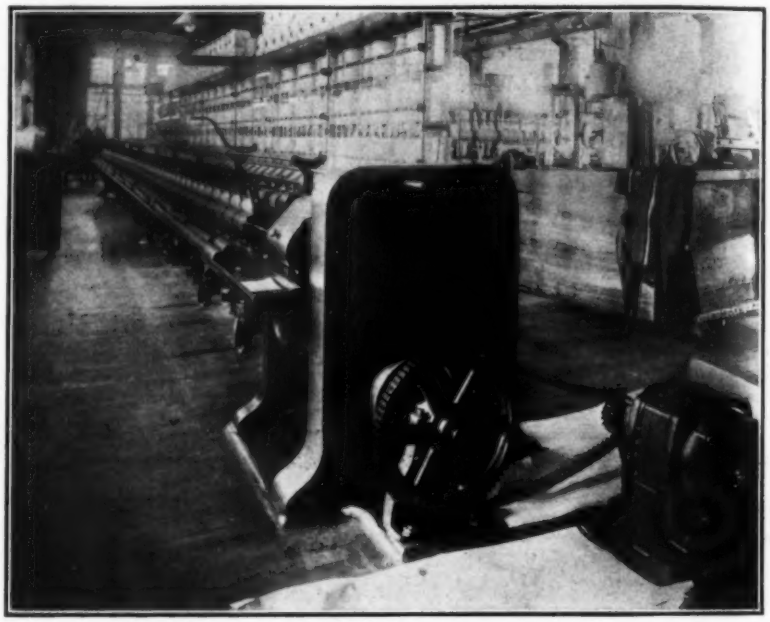
Cards, Combs, Sliver and Ribbon Lap Machines. These machines are either shut down for grinding or cleaning part of the time or take very little power, and their drive is smooth and jerkless. Here group drive has proven most economical, since the motor need only be large enough to handle machines actually running at one time. If individual motors were used, each would have to be large enough to run its machine and the total power of all motors would be greatly in excess of the power needed for a group drive.

The individual drive would also be expensive as compared to the group drive since cost per horsepower of motor is less in large sizes.

The four-frame drive is unquestionably one of the cheapest and it is believed by many to be the best for slubbers, intermediate, fly and spinning frames. This drive as applied to spinning frames consists usually of a ceiling-suspended motor with four pulleys on its shafts which drive four spinning frames below by means of belts. Every machine has its tight and loose pulleys and it is operated as the operator has been in the habit of doing. Push buttons for shutting down the motor can be located where desired.

Four-frame-drive motors should have extra heavy shafts and long bearings, the former to prevent the shaft from bending and the latter to make bearings last long. All bearings should have two oil rings, large oil wells and sight-feed oil gauges placed in full view. Motors should have tapped holes on either side for oil gauges and those not desired can be plugged. At the present time one will see the old group system with long line shafts frequently used for drawing and mule spinning, but new mills will follow the latest practice.

Fly frames and ring-spinning frames are frequently driven by a direct-connected motor with satisfaction, but some connection should be provided which will admit of changing the speed should a different length of staple be used.



Motor Driving Spinning Frame.

Bending or improper humidity may make a frame require twice its ordinary driving power to start it. For this reason starting a number of motors at the same time is not always advisable. Individual compensators are sometimes used for starting, but a cheaper way is to use one compensator to start all motors in a room, the connection being arranged so that only those loads can be started at one time which cannot overtax the motor.

Unless a piece of fabric is run or pricked on to the needles, as is the case in the running on of a top or end of glove, the flat machine must always be set up on a plain rib, even though tuck rib or circular plain work is desired. For this purpose a set-up comb is provided and the first opera-

Knitting Mill Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Knitting mill manufacturing a high grade of men's union suits. Average output 100 dozen garmens per day. Thirty-five people are employed.

Total connected horsepower, 15. Number of motors, 2. Average kilowatt-hours per month, 1,493.

Kilowatt-hour consumption for 11 months: December, 1,722; January, 1,663; February, 1,659; March, 1,301; April, 1,886; May, 1,304; June, 1,569; July, 1,263; August, 1,091; September, 1,609; October, 1,358.

Load-factor, 18 per cent.

The electrical energy consumption per 1,000 garments manufactured is 50 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type.

No.	R. P. M. power.	Speed Horse-	Application.
1	10	1120	Belted to a 32-foot shaft, six hangers, and two countershafts driving 16 Stafford & Holt circular knitting machine, varying in size from 13 to 22 inches in diameter; one George W. Payne 48-spindle winder; and one small double emery wheel.
1	5	1120	Belted to two 32-foot shafts, 442 revolutions per minute, driving 28 small machines (sewing machines, stitchers, seamers, etc.) made by Singer, Metropolitan and Union Companies.

Hosiery plant manufacturing an average of 300 dozen pairs of men's, women's and children's stockings per day. Eighty persons are employed working 10 hours per day.

Total connected horsepower, 40. One motor. Average kilowatt-hours per month, 3,817.

Kilowatt-hour consumption for 12 months: April, 5,350; May, 4,680; June, 3,960; July, 3,660; August, 4,560; September, 4,710; October, 4,200; November, 4,470; December 3,660; January, 2,980; February, 3,200; March, 3,380.

Load-factor, 17 per cent; operating-time load-factor, 41 per cent.

The electrical energy consumption per 1,000 pair of stockings is 46.8 kilowatt-hours.

MOTOR INSTALLATION.

The supply source is three-phase, 60 cycles, 400 volts. Motor is a squirrel-cage induction machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	580	Belted to two 110-foot line shafts, 12 hangers each, and 19 countershafts, 720 feet, 108 hangers, driving 113 Stadard knitting machines; 14 Mayo knitting machines; 30 New Victor knitting machines; two George Lindsley 24-bobbin winders; 74 Michael & Wildman knitting machines; 34 William Beattie 18-inch loopers; one Hodge 250-ton screw press, consisting of eight 34 by 42-inch steam-heated plates; one 30-inch ventilating fan, pulley 5 by 2 inch; one 30-inch fan circulating air in a 6 by 6 by 4-foot drying oven; two 30-inch fans circulating air an 8 by 8 by 8-foot drying oven; 24 Crompton & Knowles looms; one National 48-bobbin winder; and two Atherton Machine Company warping frames.

Knitting mill manufacturing a general line of knit goods. Twenty persons are employed. The average output is 60 dozen garments per day.

Total connected horsepower, 25. Total number of motors installed, 2. Average kilowatt-hours per month, 204.

Kilowatt-hour consumption for 12 months: January, 182; February, 208; March, 134; April, 275; May, 131; June, 90; July, 128; August, 128; September, 120; October, 138; November, 166; December, 754.

Load-factor, 1.5 per cent.

The electrical energy consumption per 1,000 garments manufactured is 10 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage induction motors are used.

No.	Horse-power.	Speed R. P. M.	Application.
1	20	1680	Belted to 70 feet of line shafting, 17 hangers, driving one 5-kilowatt 110-volt generator; one G. W. Payne 48-spindle winder; one cloth turner; 11 Scott & Williams circular interlock knitting machines of the following diameters: one 17-inch, one 16-inch, two 15-inch, one 14-inch, one 13-inch; one 12-inch, one 11-inch, one 10-inch and one 8-inch.
1	5	1700	Belted to a 45-foot line shaft, seven hangers, driving one Singer seamer; two Metropolitan seamers; one Merrow edger; one Union special cover seamer; two Metropolitan staying machines; one Singer finisher; one Merrow shell; one Wheeler & Wilson tucker; one small emery wheel; and one small buffing wheel.

tion is to make a half round and then push the wires of the set-up comb through the loops, threaded in the wire and attach the weight. Next put on take-up spring, set the cams for desired class of work and proceed.

Winders, Knitting Machines, Pipe Turning Machines and Nappers. These machines require such a small amount of power and are so steady in their power requirements that every class can be satisfactorily group driven. Usually at the end of a row of knitting machines there is located a latch-knitting machine. An installation that may be considered typical of this practice is in a large western knitting mill where a 20-horsepower motor drives 81 knitting machines, 11 to 23 inch capacity; 10-horsepower motor drives 37 extra large Scott & Williams knitting machines, including a 26-inch latch knitting machine, and a 15-horsepower motor drives 21, 40-spindle winders and an elevator. These machines when their needles are frequently oiled, run for years without any appreciable power trouble.

Dye Houses. Many of the small knitting mills, and in fact some of considerable size, do not handle their own dyeing and finishing, but send their entire production to outside dye houses, or else use colored stock. The process of raw-stock dyeing has been improved in many ways and for manufacturing certain grades of hosiery, yarn colored either in skein or in the raw stock can be used successfully for manufacturing the majority of hose. For the bulk of hosiery the finished goods are either black or tan. The loop process is hard on the operative's eyes, even with white yarn, and with dark colors this objection together with the increased difficulty in detecting drop stitches and other defects in the process of knitting makes it desirable to knit the stockings with white yarn and then dye them. This problem as well as the question of the most economical way for to obtain power, must be decided in each individual instance, for some concerns are located near dye houses and can thus take advantage of this fact by obtaining the best prices. Some concerns now use special machinery which does away with the transferring process that were exceptionally difficult with colored yarns.

Group drive usually is employed in dye houses. Some of the machines being shut down a large part of the time and many of them require only a small amount of power, group drive is the cheapest here since motor capacity need not equal the total power requirements of the room or department. While alternating-current, constant-speed motors are frequently used, variable-speed motors can be used where dyeing is done at varying speeds.

Cutting Machines. These machines are often driven by individual motors with great satisfaction, but the Weyburn type is well suited to 12-group drives from a two-horsepower motor.

Sewing Machines, Winders, Presses, Etc. All the auxiliary machines in the knitting mill may be as readily driven with motors as the knitting machines themselves. An attractive drive for sewing machines is to have a motor for each table, carrying from 5 to 40 machines belted to a common shaft. The methods of mounting the motor are various. It may be placed under the table at the end or center and coupled, chained, belted or geared to the shaft.

Electrically Heated Dryers. The process of drying hosiery on electrically heated metal forms or boards, though employed for some years past by European manufacturers, has only recently been tried in this country. Heretofore drying has been accomplished by means of the steam drying box, the hosiery being stretched over wooden boards previous to drying. There are many objectionable features in this method which are entirely eliminated by the use of the electrically heated boards.

There are now available for knitting mills, particularly hosiery mills a line of electrically heated boards which embody all the salient points found in the designs used aboard and which have in addition many improved features tending to simplify and facilitate the drying process.

Actual experience in a large factory shows that the cost of drying can be cut in half by the use of these boards. By the old method an operator could board and dry 30 to 40 dozen pairs of hose per day, while using the electrically heated boards one operator has dried 20 to 100 dozen pairs of hose per day. The average time required for drying in the steam box is 10 minutes, with the electric boards hosiery are satisfactorily dried in 3 minutes. Added to this is the saving of the time between the boarding bench and the drying box in the old method.

The wooden boards with handling develop rough edges which tear the hose and cause "seconds" which must be sold at a low price. The electrically heated metal board has a permanently smooth finish which eliminates any possibility of "seconds" when drying. It is also difficult to control the temperature in the steam box and, therefore, the finish on the hose is frequently spoiled because of overheating. The temperature of the electric boards, however, can be regulated very closely which enables the operator to retain the fine finish even on light-weight hose.

One of the greatest advantages of the electrically heated dryers is that it eliminates the necessity for high-pressure steam with its attendant risk, cost of maintenance and resultant excessive room temperature.

Commercial Practice
Management, Rates, New Business

Instructions to Chauffeurs of Central-Station Vehicles.

The United Electric Light & Power Company, of New York City, has had printed a leaflet for the guidance of drivers of motor vehicles, which is given to every employee interested in this branch, and a copy is placed in the first pay envelope of every new employee who has to do with motor vehicles. They are also posted in conspicuous places in the several garages of the company.

The leaflet cautions the driver to familiarize himself with the rules of the road as laid down in the state regulations governing the licenses, and as fixed by local traffic requirements. They are also urged to keep vehicles at all times in their control and not only regard the rights of pedestrians, but to look out for the latter's safety when they are not within their rights. Detailed instructions along the line of these policies and general advice as to the proper manipulation of the vehicle are included.

OWNERSHIP OF PUBLIC UTILITIES.[1]

By John B. Miller.[2]

There are two kinds of public-utilities ownerships—private ownership and public, or as it is more commonly called, municipal ownership. The public is entitled to expect the same treatment from either kind of ownership; that is, good service at the most reasonable rates with a liberal policy as to extensions. These three things depend upon:

(1) An efficient, alert, and as near as may be, unchanging management and force of employees.

(2) The command of sufficient money at a not undue cost to promptly make needed extensions.

One advantage which municipal ownership possesses over private ownership is that, in California at least, municipal bonds can be sold on a slightly lower interest basis than privately owned public-utility bonds. Another advantage which it may be said to possess is that as a rule municipally owned plants are not operated for profit, which should enable them to make a somewhat lower rate than privately owned plants can do.

The difference in the cost of money reflected in the average consumer's lighting bill is not over a few cents a month and the advantage of it is more than compensated by the likelihood under municipal ownership of the presence of certain evils extremely inimical to good service, economical management and prompt satisfaction of public demands for service and extensions. For instance, I state above that in order to bring the people what they are entitled to receive in the way of good service, etc., the management and the force of employees must be quite efficient and as long in tenure of service as possible. This is almost impossible to obtain under municipal ownership, because instead of alert, efficient business men being obtained for management, whose only idea is that of efficiency and devotion to duty, the manager and employees are more apt to be selected, either because of political influence or ability to manipulate the plant and its system in such a way as to make political capital for the mayor, common council, or other political backers behind them.

Again, it is most difficult for municipally owned plants to obtain help, or management of the highest order, because men of ability and experience much prefer employment with privately owned corporations, where their tenure depends solely upon their ability and loyalty, and in no respect upon their ability to do politics or influence votes.

Under municipal ownership, as a rule plants are not operated for profit, or even if so, cannot be expected to earn but a moiety of the amount necessary to meet the demand for extensions, and there is greater likelihood of stagnation. If the city or territory served by the municipally owned plant, grows after its first installation to a point where there is additional territory and consumers clamoring for extensions, these cannot be made except by the sale of bonds. Municipal ownership bonds must be voted by the people. The majority of the people concerned are already served with electricity, and to vote more bonds to run extension to sparsely settled territory would mean for those who already enjoyed service only an additional tax. Consequently it has been the experience that under municipal ownership extensions are not made with nearly the liberality or promptness that exists under private ownership.

The people ought really not to care whether they are served by a privately or publicly owned corporation, providing they obtain the essentials laid down above, namely: Good service, reasonable rates and a liberal policy as to extensions.

In times past, before the regulation of public utilities by the public, a great many evils crept in. Designing politicians found public-utility corporations an easy prey for their grafting machinations, and public-utility managers were only too prone to take the easy way of pandering to the greed of these politicians in protecting the interests entrusted to their care. This is now all done away with in the more advanced and enlightened states like Wisconsin, Massachusetts and New York.

It has long been the opinion of the best thought on public-utility matters that the people are best served by having the municipality own and control all utilities having to do with health and sanitation such as water, sewers, policing of streets, etc., but all other utilities calling for a more or less high degree of technical ability and the employment of a great many men,—such as transportation, telephone, telegraph, electric light, gas, etc., carrying the chance of hazard not only financially, but as to life and property, can best serve the people when privately owned and publicly regulated.

In order to give the people the best service and the lowest rates, all public utilities should be natural monopolies.

As evidence of this you have simply to call to mind the situation where two competing telephone companies serve the same community. While the annoyance and cost is not relatively so great where two competing electric companies serve the same communities, it is almost as great because of their duplicate use of the streets and alleys, and it is just as great in case of a consolidation of the two companies (and this is almost always eventually the case) as interest must be earned upon a double investment and the cost almost invariably falls upon the consumer.

These companies should be properly regulated by a state board consisting of men chosen for the purpose, and if possible appointed for life or good behavior, but if not, for extremely long terms. Such appointments should carry good, high salaries, so as to command men of the very highest ability, intelligence and character. A state board should have full power to regulate rates, service and financing and no company should be allowed to establish business until it has obtained authority from the state board. We do not have this kind of regulation in California as yet. It is largely because this question of regulation is understood only by comparatively few. This is principally our fault, as we who are more vitally interested than anybody else, have not been as enterprising and industrious as we should have been in the education of the rest of the community. With this kind of regulation, in which the investor as well as the consumer is protected, and justice given to both, the business will take on a character of such greater stability as to enable it to obtain its money at substantially as low a rate as municipalities can do. When this condition obtains, as it is sure to do in time, private ownership under scientific public regulation will afford the most advantageous method of serving the people with public utilities other than those having to do with health and sanitation. It will provide them with all the advantages possessed by municipal ownership and none of the disadvantages such as political management, inability or unwillingness to make extensions, etc.

Both the investor and the consumer will be protected; the investor receiving a fair rate of return upon a reasonably safe investment; the consumer, good service at reasonable rates and a liberal policy as to extensions.

1 From *Edison Current Topics.*

2 President, Southern California Edison Company.

Fall River Contract.

Negotiations are going on in Fall River, Mass., for the renewal of the street-lighting contract. It is proposed to make a contract for five years at the rate of $80.30 per lamp per annum for magnetite lamps.

Electrical Construction

FIRE ALARM SYSTEMS.—IV.

Notes on the System of the City of Chicago.—I.

A description of a fire-alarm installation adopted to adequately protect a city so large as Chicago should prove of interest because of the size of the system, if for no other reason. Moreover, a study of the methods of operation and maintenance of such a plant as this is bound to be entertaining to the layman in such matters, and, at the same time, instructive and valuable to people concerned with fire protection from the technical or professional side.

The municipal equipment for fighting fires in Chicago includes 101 engine houses all well manned and having the necessary supply of modern apparatus. Engine houses are furnished with comfortable living quarters, gymnasiums, and the other things needed in keeping men charged with duties so important and so trying as those of the fireman often are, in fit physical condition. It is, however, with the provisions for transmitting alarms of fire to these houses, rather than with the equipment of them, that this article is principally concerned.

The Chicago fire-alarm system would probably be classed among the so-called manual systems. It consists essentially of street signal-box circuits over which alarms are sent, by pulling the street box in the usual way, to a main central office; of appliances at the central office for receiving the alarms and for sending these manually over other circuits extending from here through the various engine houses; and lastly, of suitable apparatus at the engine houses for receiving the alarms there. It is in order to note at this point, too, that the circuits to the engine houses pass also through the police stations of the city and through the newspaper offices, and that alarms of fire transmitted to engine houses are simultaneously received at these places also. There are provisions, too, of such a character that alarms of fire are received at the headquarters of the Commonwealth Edison Company, at those of the gas-lighting company, and at the offices of the street-railway company. At any serious fire it is desirable, of course, that all these organizations have representatives.

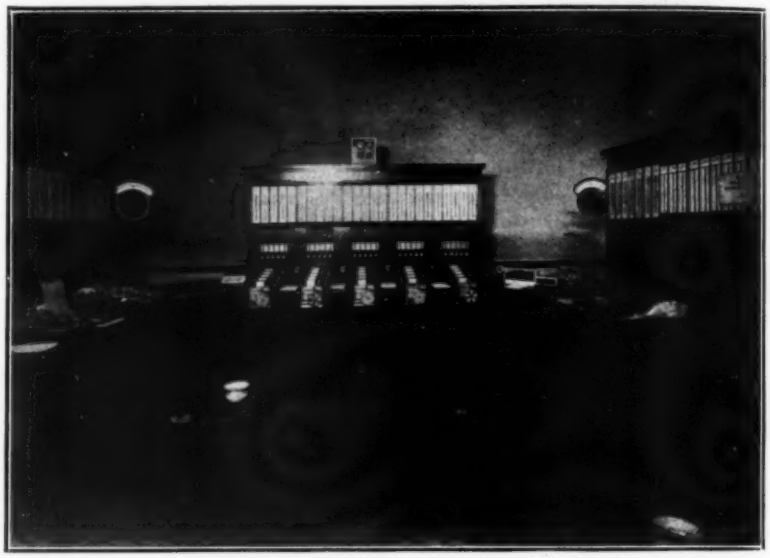


Fig. 2.—Front View of Signal Board.

Fig. 1.—View of Corner of Central Office.

The central office of the Chicago installation is in reality two separate offices. The main office is located in the City Hall building, and there is a smaller branch office in Englewood, which is a suburban district. The equipment at the branch office, however, is practically the same as that at the main office except that it is not nearly so large, and this branch station serves a section not reached directly from the larger plant.

While the Chicago system may be classified as stated above, it differs materially from other installations which might be grouped in the same

class. It was designed largely by employees of the municipal department of electricity who have given this branch of service long and careful study. Employees are selected through civil-service examination, and those who subsequently prove reliable and proficient are promoted from one position to another as vacancies occur. For example, operators and assistant operators are appointed by the fire marshal, upon the recommendation of the city electrician, from a list certified by the civil-service commission, which list is made up from men who have served in the next lower position for at least one year and who have passed examinations for promotion. By such a procedure as this it is made sure that men in the higher positions have an intimate familiarity with the plant and are capable of designing additions to it whenever these become necessary, and of directing any other changes which will assure a higher grade of service.

The location of fire-alarm boxes is another duty left to the fire marshal. Of the boxes now in use there is a total of about 2,000. The fire-alarm-box circuits aggregate 44 in number and vary widely in length. In districts where overhead lines are objectionable, the circuits are run in lead-covered cables laid in underground conduits, while in the remoter parts of the city aerial cables and open wiring are employed. From the central office to engine houses there are 16 circuits, most of which are in duplicate. The main circuit to the engine house is called the "Joker" circuit, and the other is styled the "Sub-Joker." The specific use of the two circuits will appear later.

Copper wire is used throughout all circuits, and the conductors range in size from No. 10 B. & S. gauge to No. 6.

Equipment at the Central Office.

Figs. 1, 2, 3 and 4 are photographs of parts of the apparatus at the central office of the installation in question. Current for operating the system is supplied from dynamotors built by the Holtzer-Cabot Electric Company. In all, there are 77 of these. The motor end of each one of these machines is wound for 115 volts, and the driving current is obtained from the lines of the Sanitary District of Chicago and those of the Commonwealth Edison Company. The service cutout cabinet is located in one corner of the room shown in Fig. 1, and to this the mains of both the power companies just mentioned run. A double-throw knife switch is so arranged that the dynamotors may be operated at will from either service. In this way absolute continuity of service for the fire-alarm installation is assured.

Fig. 3.—Part of Generator Room.

The central-station service in this part of the city providing only direct-current power, the dynamotors are simple machines for transforming direct current of one voltage into direct current of another voltage. In each machine there is a single armature with a commutator on either end of it. One set of poles supplies the field for both the motor end and the dynamo end of the rotating armature.

Five of the dynamotors mentioned are used for lighting a diagram in the central office, which will be described later, and for other local service. The remaining seventy-two furnish energy for the alarm circuits. Some of these seventy-two machines are designed for a pressure of 25 volts on the generator end, and others for higher pressure, 75 volts being the highest pressure of any of them. The normal rated load varies from 2.5 to 7.5 watts. They are all shunt-wound units.

The method of supporting these little machines and the manner of wiring to them is rather clearly shown in Figs. 3 and 4, and is well worth consideration on the part of electricians interested in high-class construction work. As the figures show, the dynamotors are supported on two racks built up of angle-iron. They are

Fig. 4.—Rear View of Machine Rack.

bolted to these frames securely, with three units in each of the twelve vertical rows which make up the group of machines for one rack; or, in other words, there are three horizontal rows of machines with twelve units per row, and corresponding units in the three rows are arranged one directly over the other. From the cutout cabinet referred to above two runs of conduit extend to the bottom of each rack, and in these are run the wires leading to the motor ends of the dynamotors. The pipes for one group are shown in Fig. 4, one of them running from the front end of the rack and along the base of it for about half its length, and the other conduit extending along the entire length of the base of the rack. These pipes are fitted with condulets through which wires are brought out for the motor feeds, there being a condulet for every six machines. From the two wires brought out at this fitting the motor leads branch off to push-button snap switches, and there is one of these for each separate motor circuit. Leaving the snap switches, the branch motor leads pass through a type A condulet into one of the short vertical pieces of pipe shown in Fig. 4, leads for three motors being carried into the bottom of each one of these pipes. For outlets to the motors other condulets are employed, and through these the generator leads are brought back into the pipe also. Each condulet cover is provided with four holes for the purpose mentioned. Through condulets at the tops of the short pipes the dynamo leads are carried to the generator distributing panel shown near the bottom of Fig. 5, after which they pass through the main operating boards shown in Figs. 3 and 2, and through oil switches on a terminal rack, and thence to outside circuits.

Methods of Handling Alarms.

The fire alarms taken care of by the central office of the Chicago system and by the Englewood branch of this office are of two kinds; namely, those alarms which are sent in by pulling a street signaling box, and those telephoned to the central office or to the branch office. Alarms of the second class are usually styled "still" alarms, and will be referred to as such in subsequent remarks. The procedure in handling alarms transmitted from call boxes will be considered first, however.

The box circuits are closed circuits, and the boxes themselves are of types previously described in this series of articles. So much has been said about the operation of this apparatus that a further account of it here is not considered necessary.

Whenever a street box is pulled the alarm comes to a switchboard like that in the center of Fig. 2. The bell on the top of this board begins to ring as soon as a break occurs in any signal circuit, and if the break is due to the operation of a box, the bell will sound and repeat the number of the box. The board is equipped with a telegraph sounder, and in every incoming circuit there is also a printing register. In the upper part of the board, too, there are narrow panels of white paper, one of them for each circuit, and on these are printed the numbers of the boxes, there being one panel per circuit and any one panel containing the numbers of all the boxes on its circuit and only these. Behind each panel is a linolite lamp, the rays from which make the numbers very conspicuous while an alarm of fire is coming in. A three point switch on the board makes it possible to receive an alarm over the bell, or from the sounder or from the register. The practice is to leave the switch in the proper position to operate the bell. At the first break in a signal circuit caused by the operation of a street box the bell rings and the linolite illuminates the paper panel corresponding to the circuit which has been opened. The operator generally prefers to get the number of the box from the printing register, and hence he immediately cuts this into service and notes the location of the box which is operating. This done, he turns quickly to a telegraph key, and, by the manipulation of this, strikes the first two rounds of the alarm on the circuits from central office to engine houses. These circuits, it will be recalled, have been styled joker circuits. The two rounds sent in thus are received at the engine house on a telegraph sounder and a printing register. At the conclusion of these two rounds, the operator sends in two others over the circuit known as the sub-joker, and these rounds are received on a bell and a register. The existence of two complete circuits to every engine house is the best sort of assurance that it will always be possible to send in signals promptly. Moreover, the joker lines are paralleled with a telephone line which is a part of the fire-alarm installation.

Since all of the joker lines become operative whenever one of them does, all other companies always know what companies are called from an engine house to a fire. As soon as a company returns from a fire, it makes that fact known to the operator on duty at the central office by means of a signal sent over the joker circuit to a telegraph sounder in the central office, this signal being governed by the manipulation of a telegraph key in the engine house. Having received this signal, the man in charge at central immediately repeats it to all the other companies. There is a single master key on the board shown in the left side of Figs. 1 aand 2 for this purpose.

When a still alarm is received at central office it comes to a telephone board which is a part of the large switchboard in the left-hand side of Fig. 1, and also to another telephone switchboard at which an operator is always seated. By the operation of a key in the joker circuit, the attendant immediately calls the company nearest the fire, and this signal is also heard, of course, by the other companies of the fire department. The operator then announces the location of the fire over the telephone, which announcement is received simultaneously at all engine houses.

Circuit Connections in Fire-Alarm Headquarters.

Fig. 5 is a working drawing of the connections at the central office of the call-box circuits of a part of the Chicago installation. The double-pole snap switches connecting the dynamotors to the sources of power for these have already been discussed at some length, as have also the resistances in the lines outgoing from the low-voltage sides of the machines. The generators are connected to the vertical bars of the generator distributing panel and the outgoing lines to the horizontal bars. By means of plugs screwed into holes through the outer bars where vertical and horizontal bars cross, the outgoing circuits are connected to the dynamo leads. For instance, as these plugs are arranged in Fig. 5 the circuit connected to the two upper horizontal bars would get its energy from the dynamotor at the extreme left-hand end of the group of units shown in the drawing.

From the panel just mentioned the path of the current is: past point *A;* downward through the telegraph relays; upward past points *B*; through the overload relays at the top of the figure; out to the cable terminals; and thence to the street boxes. The path of the return current is through the right-hand ends of the overload relays; down through *C* to the cable; and back to the generator. As is seen, it is assumed here that the left-hand one of each pair of wires is the positive one; but, so far as this description is concerned, it is not material which one is actually positive.

At *B* there is a switch for shunting the ammeter out of circuit; at *D* there are switches for testing either side of any circuit for grounds; and just above *D* there are switches for making permanent grounds whenever these are wanted. The lightning arrester switches are clearly indicated. The oil circuit-breakers open the lines if the current in them becomes excessive; they are closed by means of solenoids energized through push-button switches on the main switchboard in the central office.

The three-point switch for shifting an incoming alarm to bell, to sounder or to register, whichever it may be desired to

use, is shown above the lower right-hand corner of Fig. 5. It will be noted that the telegraph relays which control the operation of that one of these three instruments receiving the alarm causes a small signal lamp near the relay to flash in step with breaks in the circuit. Also, as soon as this relay begins to work it pulls one of its armatures to the left and thus throws the linolite lamp in circuit where it keeps burning until it is turned off by means of a snap switch.

In following up the circuits represented in Fig. 5 the reader should not be confused by the fact that certain lines apparently representing opposite sides of a circuit are converging lines. The two lines are not wires of one circuit at all; they are simply drawn converging in order to represent a bundle of conductors of gradually decreasing number. The next article will include a diagram of joker circuits, and it and Fig. 5 will be employed in discussing methods of conducting tests on the system, and so on.

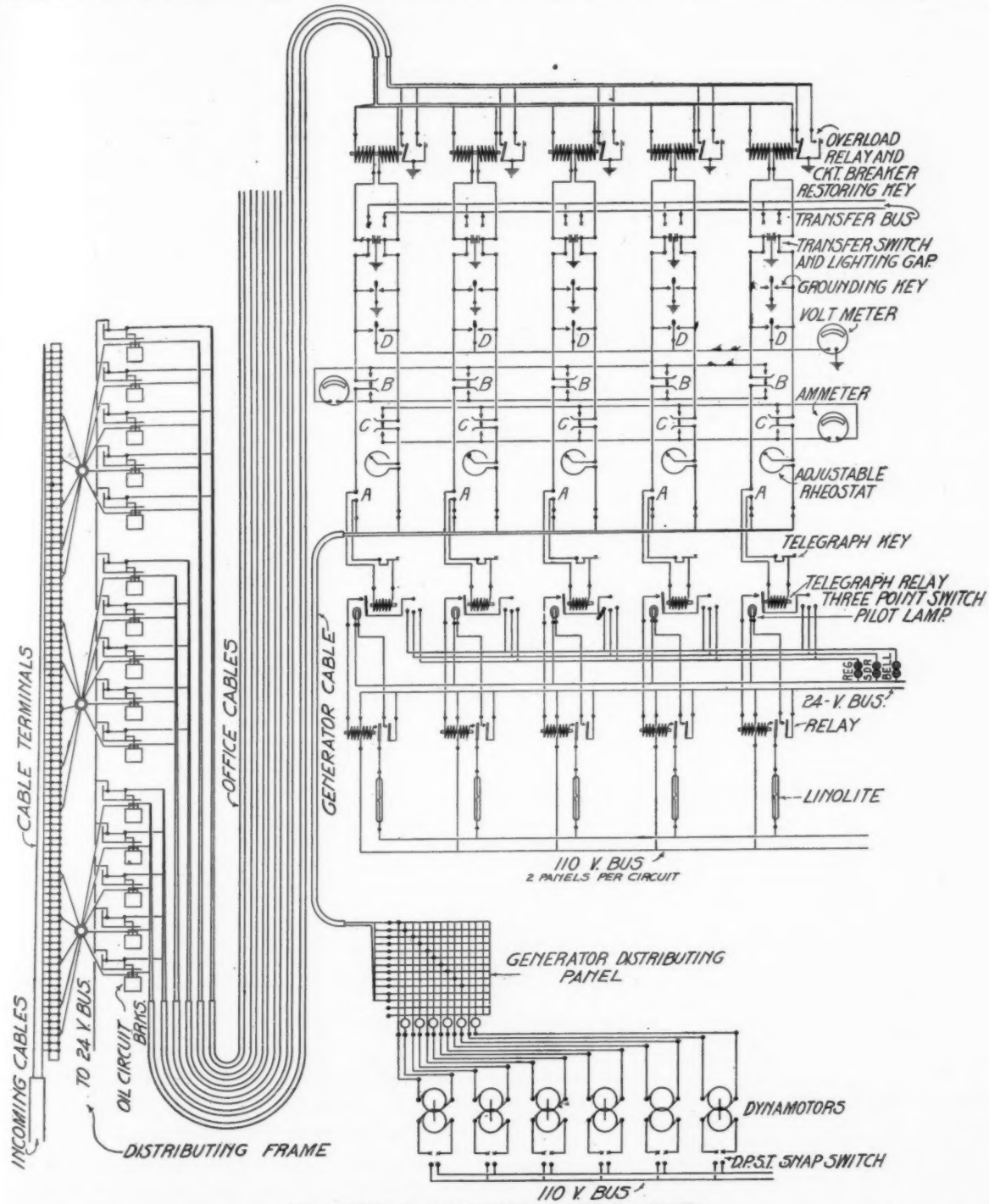


Fig. 5.—Diagram of Connections for Call-Box Circuits.

It may be worth while to state here that the four cables at the left of the two shown complete are joker and sub-joker cables.

(To be continued.)

COMMERCIAL TESTS OF LIGHTING TRANSFORMERS.

By V. M. Montsinger.

The qualifications of a good transformer are: first and most important, a good life or good insulation qualities, for on this the lives of all users of alternating-current lighting service depend; second, low losses; third, good regulation; fourth, a low heating value; and fifth, a neat appearance.

The testing of a transformer is done in the following manner:

Resistance is taken by holding about 10 per cent of full-load direct-current amperes, so as to get a good reading on the meter (millivolt), but not enough to heat up the windings in case it takes some time to adjust the

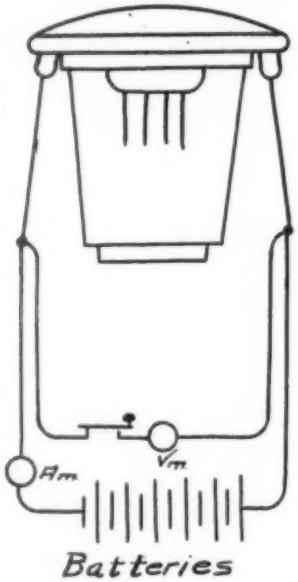


Fig. 1.

meters. When holding less than three amperes, the current taken by the millivoltmeter should be subtracted from the current held, as it is an appreciable per cent. The resistance of voltmeters is given, so the voltmeter current can be calculated. See Fig. 1 for connections.

Polarity is determined with the resistance instruments. The current and volt leads are connected on one side, either low or high-tension, and a small positive ammeter and voltmeter reading taken. The circuit is interrupted and the volt leads are moved across to the opposite winding, care being taken that they are not crossed in doing so. The circuit is closed, but the voltmeter press button, Fig. 2, should be left open. The press button is now closed (no reading is indicated), but on pulling open the current switch an electromotive force is induced in the opposite winding from induction and a small positive kick is indicated by the voltmeter if the polarity is "positive" and vice versa. The ammeter only serves to indicate that too much current is not used, as the kick will be sufficient to bend the voltmeter needle if the current is large.

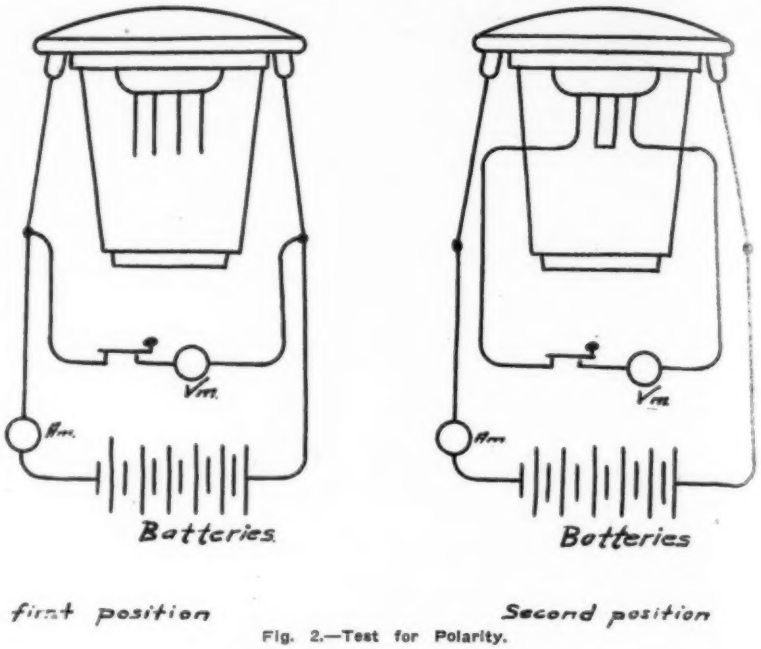


Fig. 2.—Test for Polarity.

Ratio may be taken either by the opposition or by the two-voltmeter method. The former method is generally used, as it is more accurate. The transformer to be tested is placed in opposition to one of the same ratio, but known to be correct, and a three-volt voltmeter is placed in series with the high-tension winding (Fig. 3) and normal excitation held on the low-tension winding. In the two-voltmeter method the high-tension voltage is stepped down to approximately the low-tension voltage by a transformer of correct ratio. Three readings at 80, 90 and 100 per cent of rated voltage are adjusted on the low-tension side and the high-tension voltage read. The voltmeters are exchanged and the readings repeated, thereby eliminating errors due to the meters, and the average of the six readings "held" compared to the average of the six readings "read" multiplied by the ratio of the stepdown transformer. Any transformer 0.5 per cent off ratio at no load is rejected. 1.95 per cent drop is allowed for full non-inductive load. The drop at different loads, or regulation, may be measured, but this is seldom done in commercial testing, as it can be calculated accurately enough for commercial purposes.

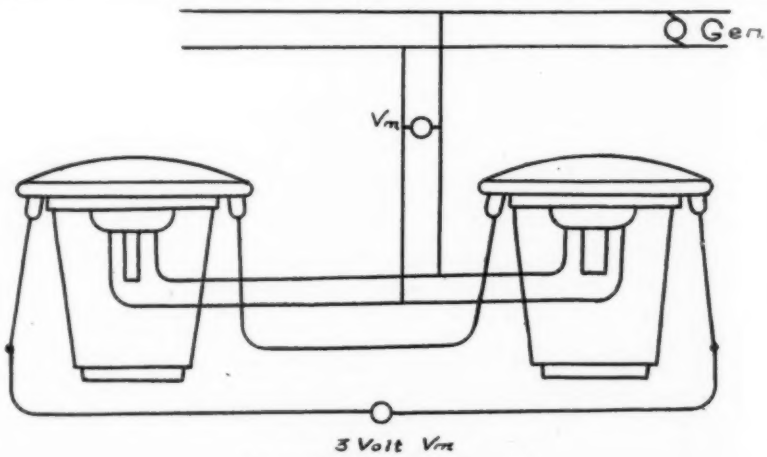


Fig. 3.—Opposition Test for Ratio.

The total resistance drop is expressed as a per cent of the rated voltage, and the total reactance drop is measured and expressed in the same

way. The latter value is multiplied by itself, divided by 200 and added to the resistance drop to give the regulation in per cent for a non-inductive load. For example, if the resistance drop for full load is 1.2 per cent and the reactance drop is also 1.2 per cent, then the regulation is $1.2 + (1.2)^2/200 = 1.21$ per cent.

With lagging currents the power-factor must be considered.

Core or iron loss and exciting current are taken on the low-tension side, and should be taken direct as to current whenever possible, as instances are known where current transformers were used and due to the phase displacement of secondary of current transformer when worked at less than one-third of maximum rating, the correct watts were not recorded (see Fig. 4). In measuring three-phase core loss, three sets of readings are taken, holding each time a different line as the neutral. An average of the three resultant readings is taken for the loss.

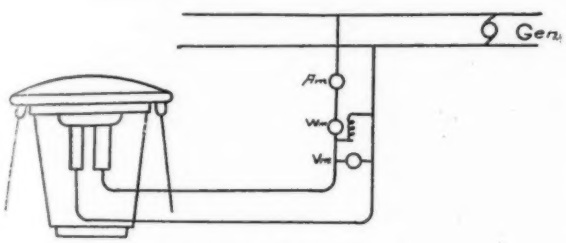


Fig. 4.—Test for Core Loss.

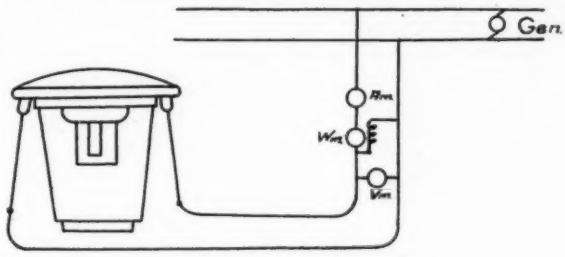


Fig. 5.—Test for Copper Loss.

Copper loss and impedance volts are taken on the high-tension side with the low-tension short-circuited (see Fig. 5), and the same instruments can be used as were used for core loss. Instrument losses must be subtracted from the observed loss for both copper and iron losses. The instrument loss may be measured by disconnecting one lead from the transformer and holding the same voltage on them as was held on the transformer, or the loss may be computed from volts and resistance.

Below 10-kilowatt sizes the measured copper loss should be about the same as the calculated I^2R loss. Above this size it is more than the I^2R loss, due to reactance, but if more than 15 per cent, the transformer is rejected.

Efficiency is calculated by knowing the iron and copper losses. The iron loss remains the same at different loads, but the copper loss changes and is easily calculated for any load. The copper loss varies as the square of the current. So at one-fourth, one-half, three-fourths, full, and five-fourths loads the copper loss changes as one-sixteenth, one-fourth, nine-sixteenths, full and one and one-half of normal full-load copper loss. Efficiency = (input — total loss)/input.

Heat runs are made on all sizes by holding 230 per cent load on short-circuit or impedance connections (Fig. 5) on the smallest size, to 160 per cent load on the largest size, for one-half hour without oil. But when a new style comes out one of each size is given a heat run on full load, non-inductive, by loading it on a water box or lamp bank. Or two transformers of the same rating may be given a heat run on the opposition method where only the losses have to be supplied. This method is used altogether on large transformers and has been checked by a non-inductive run and found to give the same results. In the opposition method the loading is generally done from a separate source of power than that supplying the excitation, as it would require some regulating device such as a compensator or transformer with many taps, to get the proper impedance volts for loading. (See Fig. 6.)

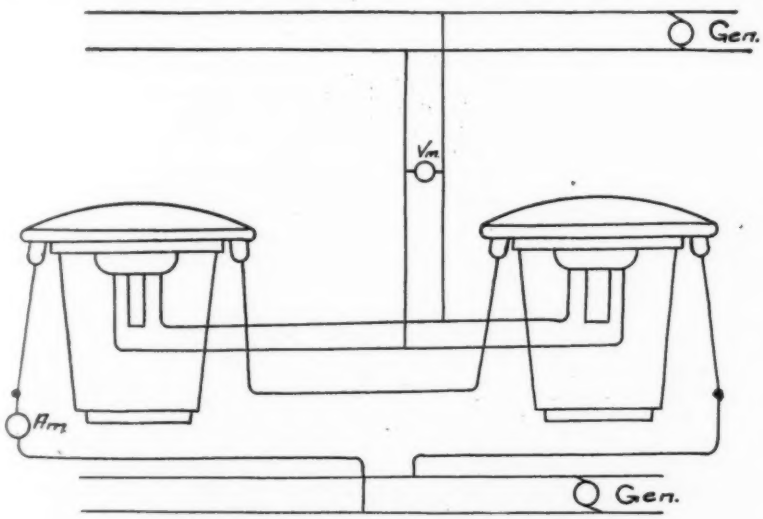


Fig. 6.—Heating Test by the Opposition Method.

All heating guarantees are made with a maximum rise of 50 degrees centigrade, by resistance, above 25 degrees centigrade. If the room or idle unit is used to base the rise from is not 25 degrees, the observed rise is decreased by one-half per cent for each degree that it exceeds 25 per cent (see A. I. E. E. rule). For example if the room temperature is 15 degrees centigrade the observed rise is multiplied by 105; or if the room temperature is 35 degrees the observed rise is multiplied by 95. It is obvious that this difference or change is due to the I^2R loss at final temperatures.

Insulation test should be made while the oil is hot as it is weakest then.

To test the insulation between coil layers, one and one-half normal voltage is applied for five minutes, then double voltage for one minute and sometimes triple voltage for 20 seconds. Usually one will stand ten times normal voltage before breaking down. The frequency for this test is 200 cycles, to limit the exciting current. Whether triple voltage is applied or not depends on the design of the transformer. The insulation between the high and low-tension coils, and between the coils and the case, is tested by applying 10,000 volts from high-tension to low-tension and case, the low-tension being grounded to the case, for a 2,200-volt, high-tension transformer. It will stand from 25,000 to 30,000 volts before breaking down. The low-tension winding is given 4,000 volts to high-tension and case, and it will stand 10,000 volts or over before breaking down. Transformers of higher voltage are given a high-potential test of from 2 to 2.5 times rated volts.

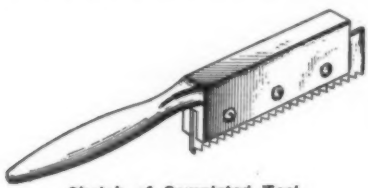
TOOL FOR SLOTTING COMMUTATORS.

By L. G. Frank.

It happens frequently with direct-current motors that, on account of the mica insulation between the copper segments of the commutator being excessively hard, the brushes will spark and heat and blacken the commutator considerably. In order to overcome this, the mica should be cut down from a thirty-second to a sixteenth of an inch below the surface of the copper of the commutator. This may be accomplished very conveniently by the use of the tool described below. In cutting the mica it is necessary to take the armature out of its bearings, or, at least, to remove it from the bearing next to the commutator.

The tool for doing the cutting may be easily constructed out of a piece of three-quarter-inch wrought iron and a hacksaw blade. The piece of iron should be slightly longer than the commutator to be treated, and should preferably be square in cross-section.

Using a hacksaw, cut a groove in one side of the piece of iron, along its



Sketch of Completed Tool.

length. Into this groove fit a piece of a broken hacksaw blade, having first drilled and tapped three holes in the side of the iron for setscrews to hold the blade in place. Adjust the blade so that it projects beyond the surface of the iron only by a distance equal to the depth to which it is desired to cut away the mica.

The handle of the tool can either be made separately and riveted on, or made a part of the piece of iron holding the cutting saw. The accompanying figure illustrates the tool as I have used it.

Among the Contractors.

The Livingstone-Yonge Company, well known electrical contractor of Jacksonville, Fla., has an order to erect an extensive ornamental street-lighting system in that popular Southern winter resort. Nine blocks of the principal business portion of Jacksonville are to be improved in this fashion. The municipal authorities have agreed to furnish the current for the clusters free of charge.

Among the electrical wiring jobs just being finished by Snow Brothers, of Brockton, Mass., are the new Howard School, the Sampson Block and the Thompson Block, all in Brockton. Snow Brothers is an old established electrical contracting house and is composed of four brothers, each of whom is actively engaged in the business, and the resulting personal attention given to each detail of the business is largely responsible for a successful organization.

The Marine Electric Company, of Louisville, Ky., has closed contracts recently for considerable high-grade work. Conduits and cables for between 50 and 75 incandescent lamps in the residence of J. W. Eckert, in Castlewood, a residential suburb of the Gateway City, are to be installed, and the Marine wiremen are re-wiring the old Roman Catholic church of St. Charles Barromeo, as well as the store of S. M. Raffo & Company.

The Queeney-Forbes Company, electrical contractors, of Woburn, Mass., have recently moved to new qaurters at 7 Montvale Avenue, where a stock of supplies and fixtures will be carried.

Daubert & Schrecker, of Louisville, Ky., have secured the contract for installing conduit wiring in the residence of Joshua D. Powers in that city. This residence is to be wired for a number of heaters and appliance connections, as well as for about 75 lamps.

The Blumenthal-Kahn Electric Company, Baltimore, Md., is wiring one of the oldest residence houses in that city, which is being converted into an apartment house. Apartment houses are at last being introduced in larger numbers in that city and are creating a great deal of work for the Baltimore contractors. This company has also secured the contract for wiring the new department store of Lauer & Company on North Gay Street. This installation will be entirely in steel conduit with panelboards of slate.

The Wilson-Maltman Electric Company has recently purchased the interests of the Electric Installation Company and has leased the entire building at 30 South Charles Street, Baltimore, Md. Extensive improvements will be made in order to furnish facilities, for a shop, warehouse and show room. A complete line of electrical supplies and lighting fixtures will be carried. This company has been awarded the contract for the electrical work in the new 12-story building for Robert Garrett & Sons, and also for the work in the new Polytechnic Institute in Baltimore.

A. C. Moredock, a well known electrical contractor, has embarked in business for himself at 732 Second Street, Henderson, Ky. Mr. Moredock has had wide experience in the trade, having formerly been manager of the Ransley Electric Company, Owensboro, Ky., and of the Henderson Electric Company, in Henderson, for a number of years.

One of the most important electrical contracts of the year in Louisville, Ky., has been secured by the Harry I. Wood Company. This is the contract for wiring and otherwise equipping the new building which is being erected on the northwest corner of Fourth Avenue and Broadway. This structure, located upon a site which is valued at more than $200,000, will contain twelve stores and a commodious dance hall, requiring the installation of more than 4,000 lamps.

Several motor sales have been made recently by C. C. Childers, of the contracting firm of Childers & Waters, Louisville, Ky. Mr. Childers sold to the Kentucky Plating Company, a concern which does nickel-plating for stove-founders, and which recently moved to Louisville from St. Louis, Mo., a 10-horsepower motor. A one-horsepower motor was purchased by the Imperial Knitting Company. A third motor, of three horsepower, was sold to Bilger & Harding, Louisville safe experts.

Sampson and Allen, of Lynn, Mass., has under way a $4,000 wiring contract for the installation of distributing feeders in the ten shoe factory buildings of the Pennell, Dearborn & Hoovey estate. Besides doing most of the electrical contracting business in their vicinity, this company also has a very heavy supply and fixture trade.

The firm name of Joseph J. Cannell & Company, electrical contractors, of Everett, Mass., has recently been changed to Joseph J. Cannell. It is a matter of note that Mr. Cannell has conducted this business in the same location, 20 Chelsea Street, for the past 18 years, and that during the past five years he has employed the same force of workmen, who have worked 52 weeks in the year.

Alphonso M. Berger, an electrical contractor, 211 North Calvert Street, Baltimore, Md., has filed by his attorney, a petition in the United States District Court asking to be adjudicated a bankrupt. His assets are $672.81 and liabilities $2,141.78. The petition was filed November 20, 1912.

Among the Supply Men

The Columbia Electric Company, St. Joseph, Mo., is conducting a special sales campaign on "everything electrical." The salesmen of this company talk the quality of its goods and the prices take care of themselves on the basis of "price is a good salesman, but quality a better one." The traveling salesmen report business improving in all sections, and that credit conditions are much better in Oklahoma and New Mexico. Special demands are being experienced for small electric lighting plants. These are growing in favor for farms and private dwelling use, and the company has installed a number of these during the past year. A sales meeting will be held about January 10, 1913, to formulate plans for the extension of territory.

The Varney Electrical Supply Company, Indianapolis, Ind., reports business generally good. Mr. Varney, president of the company, is personally calling on the Illinois trade in connection with the Indianapolis Trade Association by way of a special train throughout this section. The company is issuing a new general catalog which will be ready for distribution about December 1.

The E. A. Greene Company, Limited, Toronto, Can., reports business very active. The company is conducting a special sales campaign, sending to a selected list of contractors a card which reaches the customer in his morning mail every Friday. This gives the customer an opportunity of making a quick selection of the material he may be in immediate need of, and gives him an opportunity to participate in the chance of winning an automobile. This is producing excellent results. The company is planning a monthly bulletin which will be printed in its own office. E. A. Greene, manager of the company, expects to visit the States at an early date, and will spend some time particularly in Chicago.

Leroy A. Mills, president of the Mills Electric Company, Peoria, Ill., reports that his company is conducting special sales campaigns on Christmas novelties and "Eveready" flash lights. He also reports that it has added Ralph Miller, formerly electrician in the United States Navy, to the sales department. Mr. Miller will cover the state of Iowa.

The Commercial Electrical Company, St. Louis, Mo., is starting an active campaign on its new high grade Commercial wire-drawn lamps, and on Christmas tree lighting outfits. The company has placed on the market a new dry battery especially adapted for ignition work. This is called the "Commercial Blue Spark Cell." The company reports that since September first it has sold over 30,000 of these. Although business was rather quiet during the election season, it is now picking up.

The Electric Appliance Company, San Francisco, Cal., reports that it is conducting a special sales campaign on Copeman automatic electric cook stoves, and has been very successful so far in securing orders.

J. P. Coghlin, treasurer of the Coghlin Electric Company, Worchester, Mass., reports that it is experiencing special demands for motors, and that business is generally good and ahead of a year ago.

The National Electrical Supply Company, Washington, D. C., reports that its salesmen show very good business from all quarters. E. C. Graham, president of the company, together with the southern representative, have just returned from North and South Carolina and Georgia where its jobbing business has grown to a considerable extent. Mr. Graham made this trip in order to become personally acquainted with the trade in the above mentioned states.

The R. W. Hodge Electric Company, Kansas City, Mo., is now conducting one of its most successful sales campaigns on reflectors, shades and other intensifying medium. The company reports a greater interest and a larger response in this line than ever before, this being due, it is believed, to the great saving in current through the use of Mazda lamps.

The James Clark, Jr., Electric Company, of Louisville, Ky., recently sold to the Hyde Park and Nicholas Senn High Schools, of Chicago, Ill., 27 three-phase, 60-cycle, 220-volt induction motors for use in the manual training departments of those schools.

To meet the demands of his growing business, M. J. E. Roddy, a jobber of Baltimore, Md., has leased the building 119 North Liberty Street and will occupy it just as soon as improvements are made. The location is a very good one, being convenient to a great many of the contractors of that city.

For the second time within three weeks fire visited the basement of Eugene I. Rosenfeld & Company's electrical supply house at Howard and German Streets, Baltimore, Md., about 2 a. m. on November 21 and did considerable damage to the stock in the fixture department. Had it not been for an automatic fire-alarm system which was recently installed, the fire would have proven quite a disastrous one.

The Electric Utilities Shop has been opened at No. 3 South Wabash Avenue, Chicago. This shop offers to the public an opportunity to examine and test standard electrical current-consuming devices and fittings. The shop is laid out with an eye to every convenience. There is plenty of light, and everything is where the prospective customer can see it.

The H. W. Johns-Manville Company has recently opened a new Southern warehouse at No. 31½ South Broad Street, Atlanta, Ga. The entire building, embracing three floors and a basement, with a total floor area of about 10,000 square feet, will be utilized exclusively as a warehouse for a stock of such J-M products as roofing, boiler and pipe coverings, cements, packings, fire extinguishers, electrical, railway and automobile supplies. A feature of particular advantage in this new site will be found in the location of the Atlanta office of the H. W. Johns-Manville Company in the same building with the local warehouse, which will materially help to minimize the chance of delay in deliveries.

Public Service Commissions

CALIFORNIA.

The Railroad Commission has effected a reduction from 30 cents to 25 cents in the telephone rates between San Francisco and Hayward, and Oakland and the towns of Mill Valley, Palo Alto, Redwood City, San Mateo and San Rafael. The Commission also reached an adjustment with the Western Union Telegraph Company, cancelling the extra service charge of 25 cents for delivering telegrams to Stanford University.

Authority was granted to the San Jose Terminal Railway Company to issue $200,000 of bonds for the construction of an electric railway line from San Jose to Alviso, at tidewater. Arrangements have been made with an existing boat line to handle traffic between Alviso and San Francisco.

A decision has been rendered granting permission to the San Diego, Riverside & Los Angeles Railway Company to issue $2,500,000 of bonds. The Commission criticised several transactions of the corporation, calling special attention to the issuance of its entire stock of $8,000,000 between March 12 and March 23, the effective date of the Public Utilities Act.

Permission was granted to the San Diego Consolidated Gas and Electric Company to modify its trust deed to include additional property recently acquired by the corporation.

The Railroad Commission has arranged for a general reduction in electric lighting rates in Southern California, beginning January 1, 1913, covering a large portion of Los Angeles, San Bernardino, Riverside and Orange Counties, but the cities of Los Angeles and Pasadena are not affected by the order. The Southern California Edison Company will reduce its maximum charge from 10 cents per kilowatt-hour to 8 cents.

NEW YORK.

The Appelate Division of the Supreme Court, in a decision handed down on November 15, upholds the order of the Public Service Commission for the First District, directing the Bridge Operating Company to reduce the local car fares over the Williamsburg Bridge from three cents to two cents for single trips, and from two tickets for five cents to three tickets for five cents. Unless further appeal is taken this will bring about a reduction of the bridge fares, and will result in a saving of from $80,000 to $90,000 a year to the traveling public using the Williamsburg Bridge cars. The order of the Public Service Commission directing a reduction in fares was issued April 11, after a hearing which showed that the company was making a profit of more than 100 per cent upon its authorized capital, or more than 200 per cent upon the value of the property.

At the instance of Commissioner J. Sergeant Cram, the Public Service Commission for the First District has instructed its counsel to draft a bill for presentation to the next Legislature amending the Public Service Commissions Law by including within the First District all that portion of Long Island lying outside the City of New York and comprising Nassau and Suffolk Counties. At present this part of Long Island is under the jurisdiction of the Commission for the Second District, with headquarters at Albany, while the western part of Long Island, embraced within the New York City limits, is under the jurisdiction of the First District Commission.

Reports of gas and electric meter tests for the month of October by the Public Service Commission for the First District show that 37,949 gas meters were tested during the month. Of this number 266 were tested on complaint. Of these, 97, or 36.5 per cent, were found fast; 52, or 19.6 per cent, slow; and 117, or 43.9 per cent, within the limits of accuracy as defined by law. Thirty electric meters were tested on complaint, of which 4, or 13.3 per cent, were found fast; none were found slow, and 26 within the limits of accuracy as defined by law.

The Public Service Commission, Second District, has denied the application of the New York Telephone Company for a rehearing on the order made by the Commission October 15 requiring the New York Telephone Company to furnish telephone service to the Metropolitan Telephone & Telegraph Company at its office in New York City. The Commission has also denied the application made on behalf of the parties interested in the former Metropolitan Telephone & Telegraph Company, which was dissolved in 1896, asking for leave to intervene in this proceeding.

OKLAHOMA.

Formal application has been made to the Corporation Commission by the Pioneer Telephone Company, asking that the Commission suspend its order containing a schedule of rates to be charged by the Company to Oklahoma City subscribers. The order provided that the rates should be no more than $3.75 per month for individual business telephones, $3.15 for two-party business telephones, $2.00 for individual residence telephones, $1.80 for two-party residence telephones and $1.75 for four-party semi-selective-ringing telephones. The company contends that it can not make a reasonable profit under those rates and asks the Commission to authorize the same increase in rates which was authorized by the city ordinance recently declared invalid by the Supreme Court of the state. The schedule proposed by the company provides for a charge of $4.95 a month for individual business telephones, $4.15 for two-party selective business telephone, $2.65 for individual residence telephone, $2.40 for a two-party selective residence telephone and $2.30 for four-party semi-selective-ringing residence telephone. The Commission declined to pass on the application until after it has disposed of the attorney-general's motion to require the company to refund all charges in excess of the rates allowed under the Commission's order.

WISCONSIN.

The Railroad Commission, in a decision recently announced, has ordered the Superior Water, Light and Power Company to amend its rate schedule for incandescent lighting by decreasing the amount of energy to which the primary rate is applicable. According to the schedule in controversy, the primary rate of 10 cents net per kilowatt-hour, applies to the first four hours' use per day of the connected load. The analysis of the consumer data shows that but 1.4 per cent of the consumers use their total connected load for an average of four hours or more per day. The Commission's order will therefore operate to reduce rates.

The matters in dispute related principally to the rate of return to which the company was entitled and to the valuation upon which this return should be based. By agreement between the parties, there was no dispute over the Commission's tentative valuation of the physical property as far as it went. The question of the valuation, therefore, resolved itself into an examination of the principles underlying the allowance of intangible values and investment costs upon which the respondent company laid particular stress. According to the Commission's appraisal of June 30, 1911, the present value of the property devoted to the electric department was $295,575 and the cost of reproduction was given as $395,096. The company's book value, including allowances for discarded apparatus, discounts on bonds, reorganization expenses and depreciation in real estate, amounted to $620,900. In addition to the book value, the respondent company claimed a considerable allowance for going value.

The period of boom through which the city of Superior passed, as well as the periods of depression which followed, were reflected in the history and development of the defendant company. It was therefore necessary for the Commission, in light of its past policy, to recognize and make an allowance for the depreciation which has taken place in the value of real estate. In discussing the contention that all discounts on the 6-per-cent bonds should be included in the valuation, attention was called to the fact that the question to be determined was whether the capital required for the construction of the plants could not have been secured upon any better terms. In referring to the condition existing at the time when the bonds were sold, the Commission was of the opinion that a higher price than the one received could probably not have been obtained from outside investors in an untried enterprise of little earning power. Continuing, the Commission says, "It is difficult to see on what grounds a part at least of the bond discounts should not be included in the cost of the plant. * * * If business enterprises cannot secure capital on any better terms, then it necessarily follows that such bond discounts must represent a part of the cost of securing the capital." By this statement the Commission did not mean to imply that all discounts constitute proper additions to plant value, for such a policy, if rigorously adhered to, would react to the advantage of a company of poor credit. After reviewing the facts available, the Commission considered that a sum not to exceed $26,000 should properly be added to the valuation of the electric department for rate-making purposes. This sum represents the estimated amount of discount over the prevailing rate of interest necessarily made in an open market to secure the funds for construction purposes.

In considering the claim of approximately $780,000 for going value, the Commission, in commenting upon going costs incurred during years of depression, stated that "It is not clear that such losses due to lack of growth or retrogression of community development should be charged in their entirety against the consumers, even though the sacrifices of the owners have been prudently made. Returns upon such total costs may result in rates not reasonably within the value of the product or service to the user." By using two bases of calculation, one, the so-called deficit method, which takes into account past losses and the offset obtained by recent earnings; and the other, the comparative plant method, in which a hypothetical new plant is constructed equal in physical cost and similarly situated to the old plant, but only reaching in its earnings the level of the returns of the old plant at the end of such term of years as was considered reasonable under the circumstances, the Commission arrived at an allowance of $55,000 for going value.

Computing depreciation at 4.5 per cent on the reproduction cost, and giving full allowance to all factors in the case, a valuation was obtained of approximately $480,000. On this basis the net earnings were sufficient to yield a reasonable return and still permit of a reduction in rates. Allowing interest at the rate of 8 per cent, the following unit costs were obtained:

Hours use per day.	Capacity Cost. Cents.	Output Cost. Cents.	Total Cost per kilowatt-hour.
1	9.41	2.97	12.38
2	4.70	2.97	7.67
3	3.13	2.97	6.10
5	1.88	2.97	4.85
10	0.94	2.97	3.91

The following schedule was considered equitable for residence and business lighting:

10 cents per kilowatt-hour for the first forty hours' use per month of the active connected load.

7.5 cents per kilowatt-hour for the next sixty hours' use per month of the active connected load.

5 cents per kilowatt-hour for all in excess of 100 hours.

A minimum charge of 5 cents per 50 watts equivalent per month.

For all signs and outside decorative lighting on a yearly contract basis, a charge of 6 cents net per kilowatt-hour. For window, show-case and basement-salesroom lighting, 7 cents net per kilowatt-hour. For electric energy utilized for heating or cooking purposes, 5 cents net per kilowatt-hour.

The active connected load is to be a fixed percentage of the connected load, as follows: class A, consisting of residences, 60 per cent of the connected load up to 500 watts and 33.3 per cent of the excess; class B, consisting of banks, offices, business and professional establishments, public halls, depots, etc., 70 per cent of the connected load, when the connected load is less than 2.5 kilowatts nominal rated capacity, and 55 per cent of the excess when the connected load is greater than 2.5 kilowatts; class C, consisting of federal, state and county buildings, churches, hotels, clubs, etc., 55 per cent; class D, consisting of signs and window lights, 100 per cent.

No change was made in the power rates, for the investigation showed that the gross earnings from this branch of the business were no larger than they should be. The revenues from street arc lighting were found to be less than the cost of furnishing the service, but the Commission did not think it advisable to recommend a change at the present time, in as much as the respondent company is considering the substitution of tungsten lamps for the present alternating-current arc lamps.

Aeroplanes Discussed by Electric Club.

Eugene A. Rummler, of Chicago, interestingly discussed the subject of aeroplanes at the meeting of the Electric Club of Chicago on November 21, pointing out how the electrical industry will benefit from the growth of aerial navigation. Mr. Rummler, who has given the subject considerable study, anticipates that wireless telegraphy and telephony will come into very general use in aeroplane travel. The address was well illustrated with lantern slides showing diagrammatically the theory and construction of aeroplanes, and in conclusion moving-picture films of the Chicago meet were shown.

Mrs. Grenfell Addresses Colorado Electric.

At the regular weekly luncheon of the Colorado Electric Club, held at the Albany Hotel on November 21, a new departure from the regular order was made. For the first time in its history the Club was addressed by a woman. Mrs. Helen L. Grenfell, ex-superintendent of public instruction, spoke on "The Need of a Practical Education."

The day was termed ladies' day and a large delegation of the wives and lady friends of the club members were entertained.

The annual meeting of the Northwestern Cedarmen's Association will be held at Duluth, Minn., on January 7 and 8, 1913.

Questions and Answers

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 102.—Fenders for Automobiles.—The City Council is considering an ordinance requiring all automobiles, electric as well as gasoline or steam, to have fenders. While it is true that fenders on street cars running over a smooth track have been instrumental in saving life, I believe that it is not at all feasible to use a fender on an automobile which must run over rough pavements, through ruts and over other obstructions that would very quickly crush a fender and possibly cause a serious accident to the automobile and its occupants. Has an effective automobile fender ever been developed? Are they required in any American city?—M. C., Chicago, Ill.

No. 106.—Progress Payments for Knob-and-Tube Work.—In conduit wiring it is customary among contractors to receive 60 per cent of the contract price on completing the roughing-in work, this comprising the installation of all the conduit, outlet boxes and so forth. What is the practice in this regard on large knob-and-tube jobs, in which the roughing work includes a much larger percentage of the material and labor to be supplied? Is 60 per cent or a larger part of the total cost demanded?—W. T. K., St. Paul, Minn.

No. 107.—Thermal Cutout for Flatirons.—I understand that there have been patented several thermal cutouts for use with electric flatirons to open the circuit automatically when a certain temperature is reached and thus prevent burning out of the heating element. Has any iron on the market been equipped with a device of this kind that is both reliable and foolproof, so that it can be entrusted to the ordinary household servant?—W. L., Beloit, Wis.

No. 109.—Electric Radiators.—Why are electric radiators not so generally used in this country as in Germany and England?—B. T., Baltimore, Md.

Answers.

No. 104.—Choice of Tungsten Lamps to Suit Circuit Voltage.—What rational excuse is there for a central-station company selling nothing but 114-volt tungsten lamps to its customers when the prevailing voltage of its lines is 110 volts and the customers ask for 110-volt lamps?—D. S. C., Oak Park, Ill.

There could be a number of reasons why a central station should carry in stock 114-volt tungsten lamps when its line voltage is only 110 volts. 110-volt lamps are practically obsolete although the term is still used, being an inheritance from earlier days. The tendency of central stations is toward a higher voltage and 118 or 120 is now about standard for lamps. The reason for this is less line loss and the manufacturers have no difficulty in furnishing satisfactory lamps of this voltage. The central station you refer to is no doubt going to gradually raise its voltage and is taking this means to do so. When all lamps on its lines are 114-volt it will then probably begin to furnish 118-volt lamps and raise the voltage in the meantime to 114. Tungsten lamps are not subject to the same variation in candlepower with a change in voltage as the carbon lamps. A 114-volt carbon lamp burning upon a 110-volt circuit gives approximately 85 per cent of its rated candlepower while a tungsten lamp gives about 90 per cent. While this difference in candlepower may seem great, I doubt very much whether it could be noticed with the eye. Of course the central station's voltage may fluctuate and it is taking the precaution to furnish lamps of a higher rating so they will not be damaged by a higher voltage. A voltage higher than the rated voltage of a lamp will decrease the life and is apt to cause a rapid loss of candlepower and early blackening of the bulb.—C. T. P., San Francisco, Cal.

No. 107.—Wiring Reinforced-Concrete Buildings.—Is it practical to use concealed conduit in a reinforced-concrete building in which even the floors are of monolithic concrete? If so, how is the conduit installed?—H. S. M., South Bend, Ind.

In a reinforced-concrete building no difficulty should be experienced in installing conduits. The usual method of making an installation is to install the outlet boxes where desired on the upper side of the forms for the floor slabs, secure the outlet boxes to the form by nailing or better still wire to the form with about a No. 14 soft-iron wire. The conduits should be installed in the outlet boxes before they are fastened down and each conduit should be plugged with a wooden plug. It is also a good idea to stuff the outlet boxes full of paper. Fasten the conduit to the forms with nails bent over. Where the concealed conduits should be required to be brought out for connection to exposed conduits, extend through the forms and plug and wait until forms are removed before installing the exposed conduits. Where panel boards are to be installed place a wooden form larger than the sheet-metal box that will contain the panel and when ready to install the sheet-metal box remove the wooden form, install the metal box and fill around with plaster or concrete. It is not good practice to run larger than three-quarter-inch conduit through a floor slab as the slab is apt to be weakened even though it is reinforced. Channels can be left in the concrete walls for large risers by installing wooden forms the size of the channel desired before the concrete is poured. There are two items that should be watched very closely and that is to be sure the conduits are well plugged to prevent the entrance of water and after the forms are removed and the wire is being pulled in watch out that water does not condense in the conduits. This condensation may cause the wires to short-circuit several months after they have been installed even though the conduits were thoroughly dry at the time the wires were pulled in. This condensation is caused by the air in the rooms being warm and moist and the conduits imbedded in the concrete being cold, the warm air enters and the vapor is condensed. This can be prevented by plugging each conduit where the end is exposed with tape and painting with P. & B. compound. Be sure before the concrete is poured that no conduits have been flattened or otherwise damaged by other workmen.—C. T. P., San Francisco, Cal.

No. 108.—Lighting Store Windows from the Outside.—Has any extended use been made of the scheme of lighting store windows from the outside by means of single powerful lamps equipped with lateral reflectors to throw most of the light into the window and allowing some on the sidewalk? I saw an installation of this kind, which, while not artistic, seemed to be effective and certainly was economical. What, if any, objection could there be to such a scheme carried out so as not to be hideous?—J. P. C., Nashville, Tenn.

In New York City a number of installations of outside lights for store windows have been made, and the most satisfactory arrangement is to use an angle reflector of opaque material, such as enameled steel or even metal painted white inside. The advantage of the opaque reflector is that it lights up the window principally, and as the street is darker in comparison, the window display is more prominent than would be the case if a glass reflector, for example, were used, which would give a high sidewalk illumination as well as light toward the window. Tungsten lamps, or better still, miniature arc lamps, suspended vertically outside of the window and as much above the center as possible, with an attractive fixture and fitted with angle metal reflectors to throw the light in the right direction have proven very satisfactory and it has been found that sufficient light reaches the sidewalk at the same time.—H. P., New York, N. Y.

Some Considerations of Electric Supply.

At the meeting of the Yorkshire (England) local section of the Institution of Electrical Engineers on November 6, the inaugural address of the chairman, S. D. Schofield, was delivered. The following remarks are a portion of his address:

Tonight, I propose to ask you to consider a few points in connection with electricity supply. For twelve years or so I have been engaged in that branch of electrical engineering. I do not mean to suggest that I have learnt all that there is to be learnt in that department—indeed I speak with considerable diffidence in the presence of so many eminent authorities on that subject—but I will do my best to give you some of the results of my experience.

One lesson to be derived from the coal strike in the early part of this year, is that it is incumbent upon all supply authorities to hold very large stocks of coal, and I consider that a six months' reserve stock is by no means excessive. Ordinarily, owing perhaps to the very excellent engineering work done for our large textile and other factories, the running and maintenance of the power plant receives but scant attention, and it is only at exceptional times that the average factory owner realizes how dependent he is upon his engineer.

It is becoming a common practice for large works and factories to fall back on electricity supply undertakings when they find themselves unable to obtain coal for steam raising, and when breakdowns occur, and temporary consumers thus secured often become permanent, and turn out quite profitable. This makes it necessary to hold larger stocks of fuel than were formerly required. In providing for these contingencies it might, at some stations, under certain conditions, be sound policy to supplement a coal reserve by storing low-grade oils. This may be done by using obsolete Lancashire boilers as storage tanks, fixing them in such positions as will allow the oil to gravitate to the front of the furnaces.

One of the main things to be considered in the future is the fixing of standard pressures and periodicities. Engineers interested in the manufacture of motors or incandescent lamps well know what a boon this would be to them. The day of small supply stations is passing away, and if electrical energy is to be universally adopted for industrial purposes, at prices which will be profitable alike for the producer and consumer, it can only be done when generating with large units at stations where fuel can be obtained easily and cheaply, and where an abundant supply of water for condensing purposes is available. Generating stations which were put down to supply direct current, and which for economic reasons were necessarily in the center of a given area, will be dismantled and utilized as substations, taking current in bulk from a large central station. The question as to whether these large stations will be controlled by companies or by groups of local authorities, will settle itself in the future.

At no time in the history of electrical engineering, was there such marked activity in all its branches as there is today. The advantages of electricity for heating and cooking are now being realized, and if this new demand is properly developed it will mean not only increased quality of apparatus in use, but also new and heavier mains, and additional generating units.

One result of the very excellent plant now provided for electricity generation and distribution is a tendency on the part of engineers to become stereotyped in their methods, and in too many cases to refuse new business because it does not fall in with "red-tape" conditions. I remember some years ago, when a traction undertaking was ready for running the first trial trip, the supply station—owing to delay in the completion of contracts—was without traction switchboard, or switches, fuses, ammeter, voltmeter watt-hour meter, circuit-breaker, etc. The engineer, recognizing that the success of an undertaking often depends on first impressions, fixed up to a temporary switchboard equipped with two single-pole switches and fuses; made temporary connections, and when all was ready for the trip, threw the battery on the line without voltmeter, ammeter, or circuit-breaker. Before the regular service of cars was commenced the proper equipment was ready for use.

In another case, textile machinery had been installed in a new factory, and the owner was anxious to start running, but was unable to do so because of the delay in delivering the engines and boilers. An agreement was made to take 40 to 50 horsepower from the electric mains for a few months, but before 12 months had elapsed the demand was for 200 horsepower and the factory owner, recognizing the advantages of an electric drive for textile work, has now decided to couple a generator to his engine, and convert the whole of the power transmission to electric driving. During the peak loads at the supply station, whilst this particular load was on, lead-covered paper-insulated cables were run at a current density of 2,700 amperes to the square inch, which is not quite in accordance with the density arrived at on paper for a distributing network. The voltage drop from station to consumers was 100 volts on a 560-volt initial pressure, and the difficulty was overcome by running this particular feeder on a separate generator during factory hours, quite apart from the remainder of the supply, using the three-wire balancer for the ordinary area, and balancing the special supply by means of the battery, connecting the two ends and the middle point of the battery to the positive, negative, and neutral busbars. In many other instances throughout the country, additional consumers have often been obtained by the readiness of supply authorities and companies to step in and supply electrical energy at short notice, when the ordinary power units (steam or gas) have broken down. Apart from the particular advantage to the firm in difficulties, these cases are striking advertisements of the manifold advantages of electric driving, and of the ease with which electrical energy can be obtained in emergencies.

I mention these cases *merely to emphasize the point that supply engineers should be always open for business,* if there is a margin on the right side in it, even if it compels them to temporarily overload plant and mains. In these days of first-class plant and standardization, there is a tendency to practice caution until it ceases to be a virtue. Procure the best machinery available for the particular purpose for which it is required; have it well cared for, remembering the golden rule "A stitch in time saves nine," and when the emergency does come, and the unexpected happens, this can easily mean the difference between "a very busy time" and a complete shutdown. The human element is also an important factor in securing continuity of supply. In order to obtain the best results, divers methods are necessary with different men. With one man the best method is stern discipline; with another, persuasion; another "chaff;" while there is always that type of man known as a "sea lawyer" to contend with, and the busier this one is kept at his work, the less time he has to interfere with others. Discourage favoritism, and encourage ability. If a man is competent, steady and reliable, give him a certain amount of responsibility and latitude. Make his position comfortable, and encourage him to think about his work. The average man will value his position all the more, and in an emergency will respond for all he is worth to get this machine ready, or that joint made,

or the other motor fixed, or keep steam up, etc., as the case may be. Moreover, an appreciable amount of a chief's time in superintendence is saved, and the work goes on as well and as quickly when the foreman's back is turned, as when he is watching. It is a good thing for a junior to obtain a reputation as one who can be relied upon. There is no easy way to obtain it. It can only be acquired by hard work every day. Study your own work until no one else can do it better and very few as well. Then study the work of the next man above you until you can do it better than he. It is surprising how much easier the work will be to you, when he gets a lift and you step into his shoes. Don't think that 100-per-cent efficiency in your work one week, and 50-per-cent efficiency in the following week, is as good as two weeks at 75-per-cent efficiency each week. The 100-per-cent is too good to last, and 50-per-cent is too bad to put up with, and if it happens often will soon mean "your services are no longer required."

Poulsen Wireless.

The Waldemar-Poulsen wireless system has been successfully used in telegraphing between San Francisco and Honolulu, and as its ability to compass the Atlantic has thus been demonstrated, the formation of a trans-Atlantic Poulsen service is a natural sequel. It is more especially Canada which has evinced an interest in this particular system.

A company will probably erect stations in Ireland and Canada, in order to test the service thoroughly at first, but further large installations are being considered.

The Electrical Equipment of a German Theater.

About the middle of September there was opened at Stuttgart, Germany, the New Court Theater, the electrical arrangements of which are of interest. There are actually two theaters, one a large one with a stage and auditorium constructed on a big scale for large productions, while the other, which adjoins it, is smaller and exists for simultaneously performing productions more restricted in character. For both buildings and the management offices an aggregate of 7,500 incandescent lamps of from 25 to 50 candlepower are employed, and electricity is also largely used for heating, in addition to which there are about 60 electric motors serving to operate the stage-sinking devices, elevators, fans, pressure pumps and other devices. The Stuttgart central station furnishes a direct current, three-wire supply of 200 volts, each of the houses having two supply cables—one for emergencies.

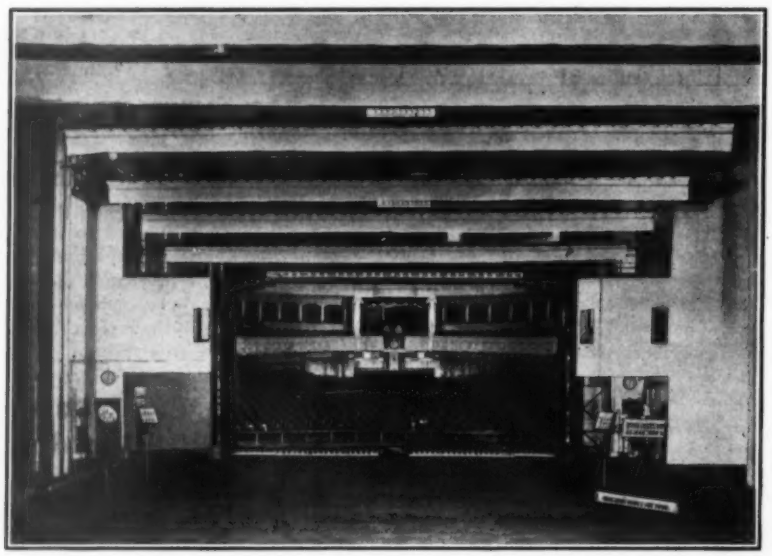


Fig. 1.—The Stage in the Larger Theater, Stuttgart.

For the illumination of the stages the much used four-lamp system is employed, splendid effects with white, red, blue and yellow lamps being obtained; separate regulation enabling these colors to be combined in almost any conceivable form and to be dimmed away very gradually from bright to dark, a natural lighting effect being aimed at. In some of the accompanying illustrations is shown the apparatus used for regulating this stage lighting. These are constructed in accordance with the most up-to-date designs of the Allgemeine Electricitäts Gesellschaft, of Berlin. There are four rows of levers corresponding to the four-color circuits, and the levers on each shaft may be moved altogether, in groups or individually, by hand-wheel or worm gearing. Both direct and semi-indirect illumination of the stages are arranged for, the latter serving to yield softer effects. The top-lights can be easily adapted for semi-indirect lighting, and an endeavor has been made to secure a more natural than usual lighting of the actors themselves by the use of soft indirect lighting for the footlights.

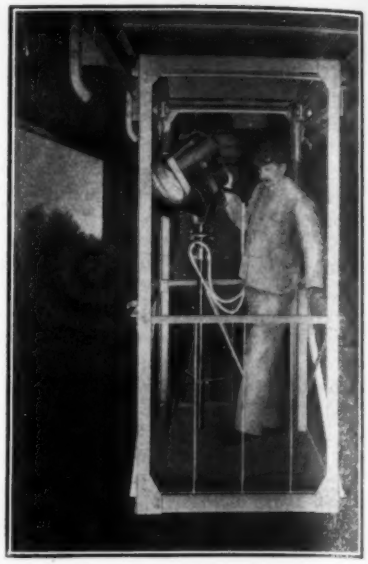


Fig. 2.—Suspended Arc-Lamp Truck.

A large search-light is placed in the ceiling above the auditorium. This both adding to the artistic effect and, by suitable shading and reflection from the walls of the proscenium, giving as nearly as possible a daylight effect upon the stage.

To Professor Littman is due the credit for this arrangement. The effect mentioned is also induced by a new arrangement of the lighting de-

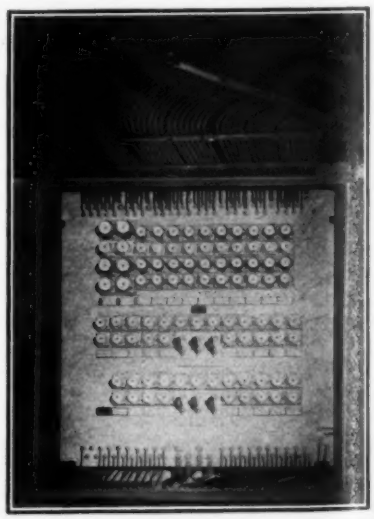


Fig. 3.—Cable Arrangement and Switchboard Under Stage.

vices used in the proscenium framework.

A further part of the installation consists of an extensive system of arc-lamp-effect lighting. Below the first machinery gallery, rails are mounted, on which special trucks are suspended which will carry "effect" arc lamps (see Fig. 2). By the appropriate movement of these lamps a flood of light may be thrown on the stage as desired.

Special attention has had to be taken to insure against failure and for securing perfect safety. There are a number of special emergency lighting circuits which are fed from a battery.

In the separate regulation of so large a number of movable circuits as such an installation involves the conductors had to be arranged so that there should be ample facility for their inspection. The main circuit distribution is arranged centrally, and the branch circuit distribution of the under stage (Fig. 3) also goes out from common subsidiary switch panels, so that all the fuses are centralized on large switchboards. The whole of the conductors are laid in conduit. An admirable scheme for the illumination of the front of the buildings has been carried out on such lines as to fit in with the general architectural design.

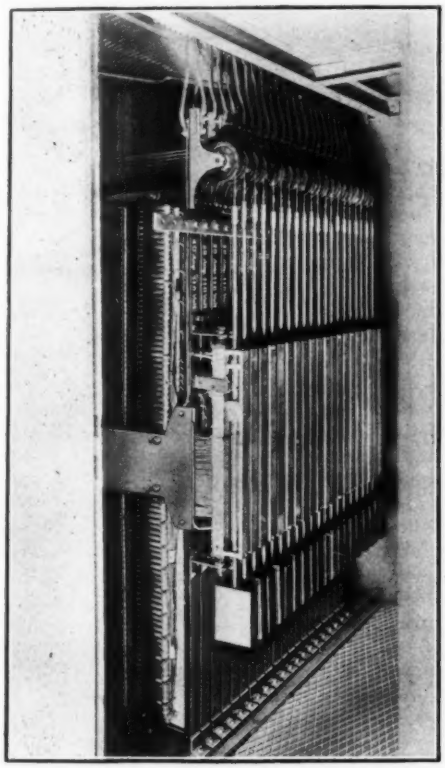


Fig. 4.—Regulator Resistances.

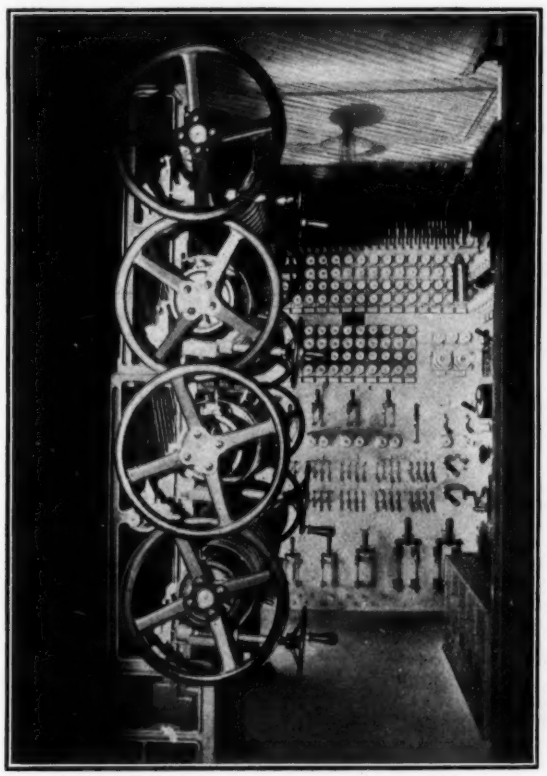


Fig. 5.—Main Switchboard and Regulator.

British Electrical Exports.

The value of the electrical manufactures exported from Great Britain and Ireland in the first seven months of this year was $11,400,000 as compared with $7,440,000 for the corresponding period in 1911. The values were distributed as follows: Submarine cables, $3,300,000; other telephone and telegraph cables, $1,020,000; other insulating rubber, $1,220,000; other insulating material, $1,640,000; telegraph and telephone apparatus, $705,000; incandescent lamps, $542,000; batteries, $521,000; all others, $2,452,000.

Electroculture in Germany.

The electrification of growing plants has the effect of accelerating the circulation of the sap and in addition diminishes the baneful influence upon the plants of insects. It also acts chemically upon the soil in such a way that the plant food is transformed so as to be more easily taken up by the roots, says the *Elektrotechnische Zeitschrift*.

The results obtained at an installation near Prague upon a farm of 36 hectares are quite remarkable. Although an unusual drouth occurred throughout the entire summer in which the test was made, the crop results were remarkably favorable. For many crops the harvest was double that obtained from neighboring areas which were cultivated for comparison and as a test of the results.

In this installation a net of iron wires was mounted upon wooden poles with porcelain insulators. The main wires were 100 meters apart and to these were attached fine wires of 0.2 millimeter diameter and 10 meters apart. This wire net was at a height of four meters from the ground, which permitted the farm work to be carried on beneath them. The apparatus was contained in a small frame building and consisted of a mercury interrupter, a transformer and rectifiers. The interrupter served to give a very high frequency, which was stepped up by the transformer to about 100,000 volts; the rectifiers permitted only one-half of the wave to be applied to the network, which was thus always charged positively, while the negative terminal was connected to the ground. This is very necessary, as alternating current exerts no chemical action upon the soil. The energy consumption is very small, as only about two amperes at 120 volts are used.

Electric stimulation was applied only for several hours a day and was discontinued during rain and intense heat. The reason for this was that during the rain the insulation becomes so bad that the energy consumption is prohibitive, and during intense heat, when the plants are almost entirely lacking moisture, the electrification injures the plants.

The results in this case were very satisfactory, not only on account of the increased growth of the plants but because the improved quality.

Commercial Aspect of Electrical Engineering.

The following are some of the more interesting points covered in an excellent address delivered to the Manchester Section of the Institution of Electrical Engineers by its chairman, A. A. Day, borough electrical engineer of Bolton. The importance of the commercial aspect of electrical engineering and the national urgency of a policy of encouragement of electrical application by the Government were emphasized. The necessity for cheapening the cost of electricity by co-operative effort, and securing the cheapening of apparatus by adopting a policy of uniformity, are parts of the scheme put forward, which, it will be observed, restates or emphasizes the "all-electric" proposal of S. Z. de Ferranti.

The application of electricity to everyday life is of national importance, inasmuch as it involves such large issues as the abolition of the smoke nuisance in our large towns, the conservation of our national supply of fuel, the utilization of waste products, and many other problems of a like nature.

The first essential to the increased use of electricity is a cheap and efficient supply; this they are now in a fair way to attain in large towns and cities, but notwithstanding this the increase in output is not advancing as it should. The main problem is commercial rather than technical.

The increased use of electricity involves doing everything on a larger scale, from power station to publicity.

In England there are far too many generating stations, and too great a variety in the types of current supplied, necessitating different classes of apparatus for its application. This prevents the manufacturer from producing in quantity, and so increases the cost of apparatus, and, moreover, it confuses the ordinary man. Simplicity is undoubtedly a large commercial asset.

With the example of the different gauges of railways is it not of the utmost importance that some effort should be made to insure uniformity, if not in detail, in main essentials?

Even in smaller matters very large economies are to be obtained by uniformity. Mr. Watson, in his address in 1909, pointed out that a capital saving of $2,500,000 could be obtained by the interconnecting of the electric supply network of the towns just around Manchester.

Supply stations and networks are going to be, in the future, infinitely larger than they are, and if extensions, when made, are controlled by certain general considerations, and plant, when replaced, is similarly dealt with, they would soon see a great difference, and a greater tendency to uniformity. It would not be necessary to aim at uniformity of the whole country on one system; the system most in use in any given area would be generally accepted as the system for that district.

If it were conceded that these things were desirable—viz:

(1) Large generating stations with large units, etc., in the interests of low cost of production;

(2) Co-operation between existing systems of supply, with a view to economizing in the cost of station plant, and also in the cost of distribution;

(3) Uniformity of systems of supply as far as practicable, and at any rate in adjoining districts, in the interest mainly of the manufacturer, but incidentally also of the consumer, by reason of the reduced cost of apparatus —is it not within the scope of the Institution to do anything towards attaining these objects eventually, and moving in that direction now?

He suggested that committees should be formed of members of the Institution representing each interest involved, viz., supply authorities, manufacturers, contractors and the commercial community. They would obtain all information necessary for a thorough consideration of the question in the area they were appointed to inquire into, and would recommend the lines on which existing supply authorities should extend, and so on to a main committee, consisting of delegates from the sectional committees, who would consider and revise the whole of the recommendations, if necessary. Having through these committees obtained the lines on which progress should be made, the Institution could approach the Government of the day, and seeing that the movement would be in the interests of all concerned and also in the interests of national economy and system instead of chaos, he saw no reason why the said committee should not be allowed to co-operate with the Board of Trade and the Local Government Board, as these Government departments were important factors in the starting of extending of any supply undertaking, and would be able to influence considerably the type of supply started or extended.

The whole process would be gradual, and would be intended to prevent the extension of the present want of uniformity and cohesion between systems rather than the enforcement of any particular system.

It should be a national matter to encourage any system of intensive culture of land, which would tend to lessen dependence on foreign food. Electricity could be used in this direction. Was it too much to ask the Government for a grant, and to help generally to start this system on a large basis, seeing the national importance that the food supply might assume at any time? A larger production of the national food supply at home would enable a larger proportion of the fleet in time of war to be used in direct hostilities, instead of having to be employed in keeping trade routes open.

A comparatively small sum would effectually prove its profitable nature to the farmer, who would adopt it from commercial motives, and if not, it would be the Government's business to see that it was done. Is it not possible for the Institution, in conjunction with the Government, to do something in this direction?

Not only could electricity, from a nationally controlled scheme, be used directly in the interests of agriculture, but, by its use in the chemical production of artificial fertilizer by the fixing of the nitrogen of the atmosphere, or by its use in chemical processes generally, as in the manufacture of electrolytic bleaching powder or for the production of disinfectant or the sterilization of water, and generally by its use in processes which would be continuous, but which could be temporarily interrupted if necessary, a load-factor hitherto undreamed of could be obtained for that scheme, with results in the cost of production that would be of the utmost importance nationally, and which, besides saving coal, would probably lead to the introduction of other industries.

He did not plead for government ownership; he did not believe that that would be beneficial, but he thought they should have more recognition and help from the Government, seeing that the application of electricity was so vital to public interests and touched national interests at so many points, and he hoped that, with their new articles of association, much more could be accomplished in the direction of influencing the Government to give to the scheme of the application of electricity to modern needs more consideration and encouragement.

Tunnel Cars for New York Mail.

It is proposed to connect the Grand Central Station and the Pennsylvania Railroad Station in New York City by means of a tunnel, through which will be operated a car for carrying the mails. It is planned to have two tracks of 20-inch gauge and cars driven by electric motors at a speed of 30 miles an hour, which will operate without motormen. These miniature cars will carry over 500 pounds of mail matter.

The operation of such a car was observed by a committee of the Post Office Department on November 21.

Electric Drive in Grand Rapids High Schools.

The motor installations in the Central and Union High Schools of Grand Rapids, Mich., are exceptional examples of electric drive for manual-training school work. In Fig. 1 is shown the wood-turning room of the Central High School. Here the wood-turning lathes are driven by one motor from a line shaft, and all other machines have their individual motor arranged for belt drive.

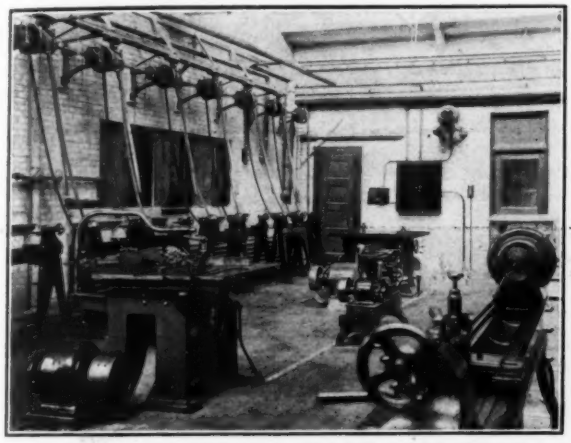


Fig. 1.—Wood-Turning Room.

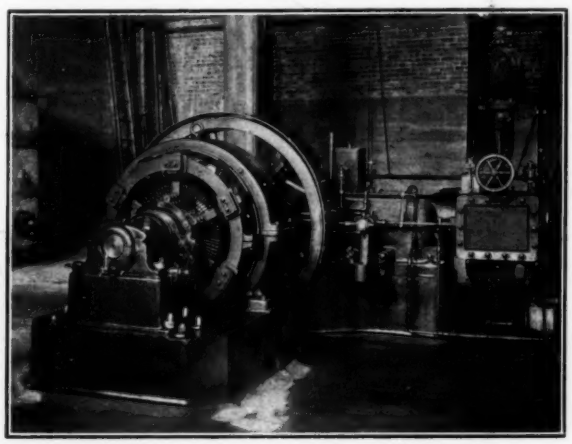


Fig. 2.—Engine Room, Central High School.

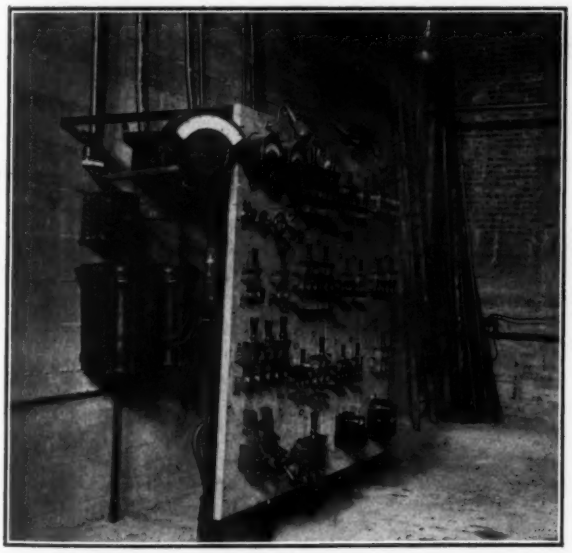


Fig. 3.—Switchboard.

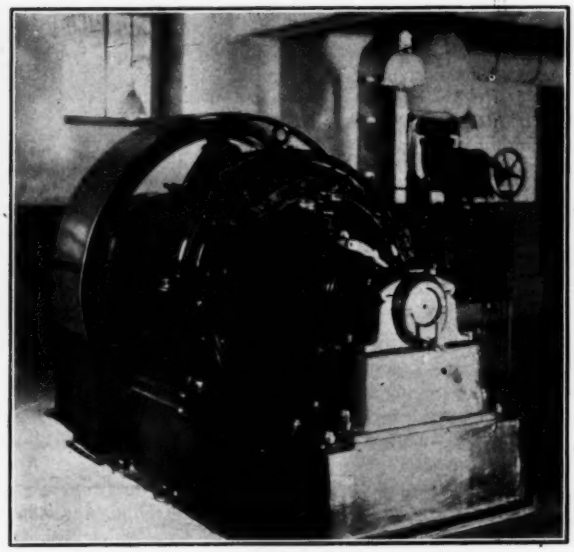


Fig. 4.—Engine Room, Union High School.

Other manual-training rooms at this school are the bench room, and the preparation room. The horsepower in motors installed in the Central High School is divided as follows: bench room, four machines direct-motor-driven, 11 horsepower; wood-turning room, six machines, 19 horsepower; preparation room, one machine, 3 horsepower. There are thus 11 motor-driven machines making a total of 33 horsepower. Also there are motors of 20 horsepower for group drive. These shops can accommodate 160 pupils per day.

Power for the manual-training department is generated in the power plant of the school. This plant is located in the basement in the rear of the building. The engine room, Fig. 2, contains a Westinghouse, type Q, direct-current, three-wire generator, direct-connected to an automatic-cutoff engine built by the Ball Engine Company. The generator has a capacity of 75 kilowatts, 125/250 volts, 300 amperes, at 275 revolutions per minute, and is of the commutating-pole type. In connection with the three-wire system, two Westinghouse 1.33-kilowatt, balance coils are used. These coils take care of any unbalancing that might take place in the system.

For controlling the power generated, a four-panel switchboard (Fig. 3), mounted on an angle-iron frame, is provided. The panel on the extreme left is the generator panel; this has two 500-ampere direct-current ammeters, one 300-volt direct-current voltmeter, a field rheostat, two generator switches and an equalizer switch. Two generators can be handled by this one panel, but at present it is handling only one. Panels 2 and 3 are fed from the municipal plant, and the power from this plant is used for lighting the school building. Lamps amounting to 70 kilowatts in capacity are installed in this building. The fourth panel is connected to the mains of the Grand Rapids-Muskegon Power Company, and power from these mains is used generally to drive a sump motor in the boiler room, and also an attic motor for ventilating purposes. However, an emergency connection is arranged so that power for lighting may be supplied by this power company. All wiring in this building is in conduit.

The boiler room is very extensively equipped. Included in its equipment are: three Hicks' horizontal water-

tube 225-horsepower boilers with Roney stokers, a Cochrane feed-water heater, feed pump, and a pressure-raising pump. Very exacting conditions are imposed upon these Roney stokers, for the school is located in one of the best residential sections of the city and smoke from this plant is not permissible. A large stack is provided for draft and carrying off any smoke that might come out. The coal used is poor slack, thus making it all the more important that the stokers prevent smoking as much as possible.

Another installation similar to that at the Central High School is to be found in the Union High School in the same city. The shops at this school are more extensive than those referred to above and consist of bench, wood-turning, preparation, machine and forge shop.

There are a large number of motors installed in this school, reaching a total of 101.5 horsepower in capacity, and divided as follows: bench room, six motor-driven machines, 17 horsepower; wood-turning room, seven machines, 23 horsepower; preparation room, three machines, 11 horsepower; machine shop, five machines, 12.5 horsepower; forge shop, four machines, 20.5 horsepower.

This makes a total of 84 horsepower, and there are 17.5 horsepower in motors for group-driven machinery. These shops can accommodate 320 pupils.

Power for driving the motors used in the various rooms, is supplied by one Westinghouse, type Q, 75-kilowatt, 125/250-volt, three-wire generator, direct-connected to an 18-by-14-inch Ball engine. The stoker, boiler and switchboard equipments are similar to those in the Central High School.

Bronx Electric Meeting.

The regular monthly meeting of the Bronx Gas and Electric Company was held on November 13. The meeting was called to order by Superintendent J. M. Butler. W. A. Root, commercial manager, presented a paper on "The History of Commercialism and Its Relation to the Central Station."

Fred Towers, electric station superintendent, presented a most interesting paper on "What Becomes of a Pound of Coal." This was illustrated by slides and charts and resulted in an interesting discussion which had to be broken up by President Rosenquest, who experienced dire fears that the B. T. U.'s and the forced draft might do some damage to the new coffee urn. A lunch was then served.

The number of telephone messages sent daily in the United States surpasses the total for all the countries of Europe combined.

Vertical Waterwheel Generators of a Novel Design.

There is a hydraulic generating station operated by the Pennsylvania Power Company at Ellwood City, Pa., which is very interesting because of several novel features that have been incorporated in its design and in the design of some of its equipment. The method of supporting the generators (Fig. 1) and the design of the generators themselves (Fig. 2) are worthy of particular notice, and will be treated in detail.

The Pennsylvania Power Company is a subsidiary company of the Republic Railway & Light Company. The output of the Ellwood City station is sold almost entirely at wholesale to municipalities and lighting companies supplying light and power to the towns of Ellwood City, Wampum, West Pittsburgh, and Zelienople. Energy is retailed only in the town of Chewton.

Fig. 1.—Interior of Station, Showing Vertical Generators.

An eight-mile, 11,000-volt line serves West Pittsburgh, and one 11 miles long extends to Zelienople and supplies numerous industrial plants and the Zelienople Light & Power Company. The maximum load is about 725 kilowatts at a power-factor of 90 per cent. The daily output of the Pennsylvania Company's station is 10,000 kilowatt-hours.

Since the installation of the generators and the turbines that drive them, the station has developed 90 per cent of its total output from water power. However, a complete duplicate steam equipment was installed. Steam pressure is not maintained but, in case of low water, it can be obtained in time to prevent interruption to the service. There has never to date been any occasion to use the steam-driven generating apparatus except because of low water.

In Fig. 2 are shown the two 2,300-volt, 625-kilowatt, 150-turns-per-minute, vertical, waterwheel generators. These are among the first machines ever built of the design delineated in Fig. 2, and are known among the station men as umbrella-type generators, because of the resemblance of the rotor to the frame of an umbrella. The mechanical design incorporates the ideas of W. E. Moore, operating manager of the West Penn Company, and the generators were developed by the Westinghouse Electric & Manufacturing Company.

The first feature that attracts attention is the fact that generators of such slow speed (150 turns per minute) are direct-connected to the waterwheel. The ordinary, but not the preferable, practice where the head is low—it is but 24 feet in this plant—has been to drive a relatively high-speed horizontal generator by a line shaft which is in turn driven through bevel gears by one or more water turbines. Through this arrangement, a high-speed generator of comparatively low cost can be used. For the Ellwood City plant, however, it was deemed wiser to connect each generator directly with its own waterwheel. The machines were somewhat more expensive, but the elimination of energy losses in gears more than compensated for the increase in cost of a low-speed generator over a high-speed one.

As hereinbefore mentioned, the other feature of the generators that is

worthy of considerable study is their unusual mechanical design. Only one guide bearing is required. The weight of the entire rotating element, the rotor and the waterwheel runner, is taken by a roller thrust bearing (see Fig. 2) located at the base of the generator. The rotor is an umbrella-shaped steel casting with four T-section arms. All of the bearings are below both the armature and field windings and the collector rings, so there is no possibility of oil being splashed on these members. Adjusting screws are arranged for centering the stationary on the rotating element.

No guards, such as are usually provided on vertical generators, are placed at the top of the machine. There is no occasion for the operator to get above the machine while it is running, hence there is no necessity for guards. Every part of the waterwheel and generator can be raised through the armature frame when dismantling is necessary.

Lubrication is effected by a continuous oiling system. The rotary oil pump (Fig. 2) which forces the oil is mounted in a pan located at the base of the generator, into which all the oil drains after flowing through the bearings. Oil from the pan is drawn by the pump through a strainer, and forced up through a pipe into an annular chamber surrounding the guide bearings. Part of the oil then flows down through oil grooves cut in the bearing, lubricating the bearing, and the excess oil flows through an overflow pipe, to the outlet, which is higher than the top of the bearing sleeve; hence thorough lubrication is assured. All of the oil that passes through the guide bearing and that which drains through the overflow pipe flows down into a chamber surrounding the thrust bearing. This chamber drains into the oil pan but the inlet to the overflow pipe is at such a height that no oil can flow out of the chamber unless the roller bearing is flooded with oil.

As shown in Fig. 1, the generators are located on a concrete deck above the station floor. Two 24-inch I-beams, one at the front and one at the rear, embedded in concrete, extend the entire length of this desk and support the frames of the generators as well as the concrete floor of the deck. This deck construction has the advantage that, with it, parts of the generators that do not require attention are raised above the operating floor, and the parts that do need frequent inspection are where they are readily accessible from the operating floor. The oil pan and the oil overflow pipes, the components of the lubricating system that must be watched carefully, can be easily inspected, and the Lombard type P governors and the 20-kilowatt, 125-volt exciters are supported at the station floor level. Another important thing about the deck construction is that the generators are located far above the maximum level ever reached by the water.

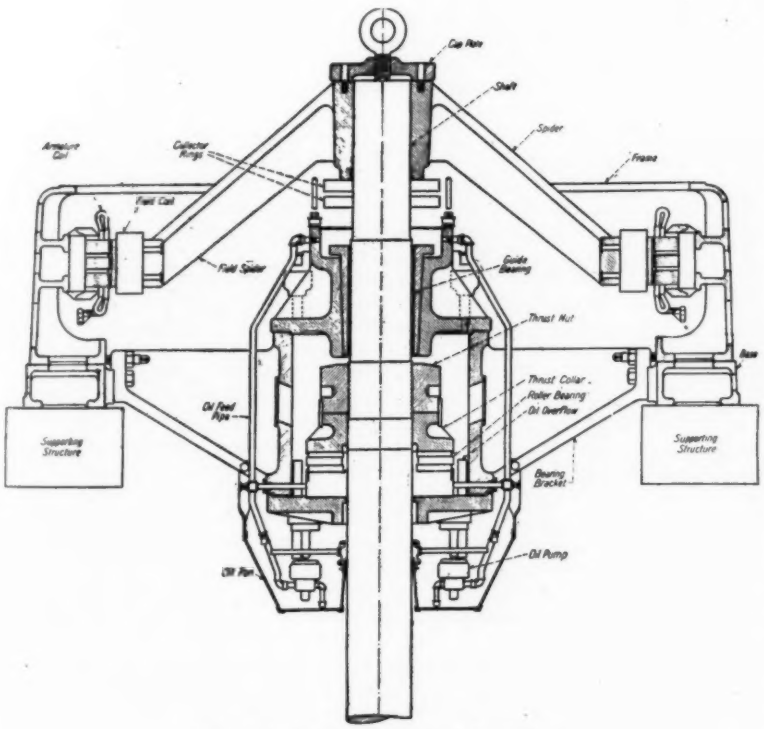


Fig. 2.—Sectional Diagram of Generator.

Although the present operating head is 24 feet, both the electric and hydraulic equipment was designed so that it will be suitable for operation at heads as high as 29 feet. The necessary provisions were made, when the apparatus was installed, whereby the draft tubes can be lengthened by five feet. This improvement will be made in the near future, and will considerably increase the capacity of the station.

The crown bearings for the turbines are so arranged that they are always surrounded by water, which eliminates any opportunity of overheating.

The auxiliary steam generating equipment consists of two 500-kilowatt steam turbines. Three 250-horsepower Sterling boilers, which supply the steam, are housed in a separate brick building detached from the generating station.

From the waterwheel generators and the steam turbogenerators, lead-covered, varnished-cambric cables, which are equipped with Davis station terminals, extend to the switchboard.

There are seven panels in the main switchboard as follows: one exciter panel, four generator panels, and two feeder panels. There are also two distributing panels detached from the main switchboard. A double busbar system of wiring is used. Each generator panel has two single-throw, triple-pole switches, so that any generator can be connected to either one of the two sets of busbars. A feature of the generator panels is that each has both an indicating wattmeter and a watthour meter mounted on it. Each has also the usual three ammeters, one for each phase, and the standard generating-panel equipment.

Each distributing panel is equipped with double-throw oil circuit-breakers, so that either of the distributing circuits can be connected to either of the busses, three ammeters and a power-factor meter. The entire switchboard was designed for simplicity and ease of operation.

There are three separate sources of excitation, so a failure in service due to the lack of exciting current is practically impossible. (1) There is a 20-kilowatt exciter belted from each waterwheel-generator jack shaft; (2) a 25-kilowatt motor-generator exciter set, and (3) a 12-kilowatt steam-turbine-driven exciter set.

A transformer station containing three 200-kilowatt transformers, which step the voltage from 2,200 to 11,000 for the transmission lines, is located near the generating station.

All the field engineering during the construction of the station was done by M. V. Knapp, who is now general manager for the Pennsylvania Power Company.

The Illumination of Workshops.

The proper lighting of a workroom is of importance both to workpeople and employers. To the former because, in many cases, where diligent use of the eyesight is necessary to perform their duties, bad lighting may cause serious injury, and to the latter because anything which interferes with the discharge of workmen's duties reduces industrial efficiency. The subject has not in the past received the attention it deserved, and the more careful study bestowed on it during recent years shows that in many instances illumination is ineffective not from absence of light so much as from improper use of it, and general ignorance of the principles which should govern its distribution.

The illumination of a room may be regarded from two points of view, according as it is desired for the general lighting of the area as a whole, or of a small circumscribed area where some specific work is being carried on more or less continuously, and practically there are always two kinds of light to be considered, viz., daylight and artificial. The principal distinction between the two consists in the variability of the former, which differs not only with the season, but from hour to hour; and a further distinction lies in: the fact that whereas we can with artifical light regulate its exact position and quality to suit the convenience of the work, the source of daylight is limited to the boundary walls of the building or to the roof. The latter is, of course, the most efficient area where it is available, but obviously that can only be on a specially arranged upper floor or ground-floor shed. In the bulk of cases window space in the side walls is the only source, and amount of light that can enter often varies considerably even in the same structure, owing to the presence of adjacent buildings. Ground floors are frequently very defective on this account, apart from deficient window area, which, to secure efficient daylight illumination, should relatively to the floor area amount to at least 10 per cent, and be as symmetrically arranged as possible to secure uniform diffusion. To this end the nature of the walls plays a more important part than is generally thought. They should be of a light tint, and of a matt surface to increase diffusion. By paying attention to this detail the illumination may sometimes be trebled or even quadrupled.

It is, however, with artificial lighting that most scope is afforded for good and bad arrangements, and where errors most frequently occur. The main principles to be observed are: (1) the light should be adequate; (2) it should not cause glare effects; (3) it should not produce troublesome shadows. The question of adequacy depends on a number of considerations, such as nature of work, fineness and color of material, etc., and is not one on which special rules can be formulated, as circumstances differ widely. The work may be of a nature which demands close application to a small area, or may only require general supervision over a given process, while individual eyesight as well as work may vary. Obviously, however, dark objects require more illumination than light ones, and where color variations occur the same should permit of adjustment, and this can usually be simply obtained by allowing a few feet of flexibility in the distance of the source. Glare effects, while readily understood in a general way, are less easy to define, but the definitions put forward by Prof. L. Weber, of Kiel, are probably on the whole the most practicable.. According to these a lighting system is glaring: (a) if the ratio of the intrinsic brilliancy of the source of light to that of illuminated surfaces exceeds 100; or (b) if the absolute intrinsic brilliancy exceeds that of an open candle flame—which is about 2.5 candles per square inch; (c) if the angle between the line of vision when directed on the work and the line from the eye to the source of light is less than about 30 degrees; (d) when the apparent area of illuminating source subtends an angle of more than 5 degrees at the eye.

To avoid glare, therefore, the important points to note are the position of the light unit, and its efficient shading. In most instances the angle of glare, which Professor Weber fixes at 30 degrees, can be easily avoided by raising the light unit sufficiently high. Some sacrifice of light is, of course, entailed in this, but if a few inches will, as is often the case, eliminate glare, the diminution in intensity is inappreciable. If the light, which of course varies as the square of the distance from the illuminated object, and as the cosine of the angle of incidence, will not permit of this, then the only remedy is efficient shading, and when this is necessary care should be taken to make the shade sufficiently deep to afford complete protection to the eyes.

Independently of this, reflectors are often of convenience to concentrate light on the area immediately beneath them, and the extent to which this occurs is illustrated by observations in a cloth factory, where the illumination intensity of metal-filament lamps at points two feet three inches vertically below the lamps was found to be 1.2 and 2.5 foot-candles without reflector and 3.1 and 7.0 foot-candles when fitted with prismatic reflectors. The nature of the shade, it may be further observed, influences the radial distribution of the light, and should therefore be selected with a view to the particular result desired. A common example of failure in this respect is often afforded when carbon lamps are replaced with metal lamps. In the latter the light is thrown out more horizontally, and therefore to obtain the full benefit of the change new reflectors should be provided.

With artificial light, troubles from shadows are more serious than with daylight, and in dealing with them two qualities are to be noted, viz., position and depth, the former depending on the position of the "local" light unit, and the latter on the general illumination of the neighborhood. To avoid trouble as much as possible, the unit serving each area should be so placed that the light falls from the side, or, better, over the shoulder of the worker. If the lamp is in front with the machine between, then neighboring lights should have access to the work to neutralize the shadow as far as possible. The suggestion seems obvious, but it is not always observed, and inefficient illumination often arises in consequence. Another common failing is the placing of lights so that they cast the worker's own shadow on his work. This is doubly annoying, because it not only cuts off light but balks the worker by its movements.

A comparison of various kinds of artificial light of course opens up big questions, and the rival merits of gas and electricity is not one into which we purpose to enter here at any length, suffice it that from a sanitary point of view the superiority of electricity as an illuminant is universally admitted, and though, as regards efficiency, incandescent gas compares favorably and even advantageously with it in some instances, nothing can be said in favor of flat-flamed gas burners as sources of illumination, though they are still extensively used. They not only flicker and evolve much heat, besides vitiating the air, but they use 12 to 15 times as much gas per candle-hour as other gas-lighting systems.—*Mechanical Engineer.*

Coal Washeries.

The production of anthracite in Pennsylvania includes an appreciable quantity of usable fuel recovered from the old culm banks by washeries, and the unsightly monuments to the wasteful methods of early times are disappearing from the landscape in the anthracite region. The quantity of coal recovered in the 22 years since the first washery was constructed in 1890 has amounted to about 50,000,000 long tons, considerably more than the total production of anthracite at the beginning of the period. In 1911 the washery

product amounted to 4,136,044 long tons. In addition to the coal recovered from the culm banks, 94,647 long tons in 1911, and 91,833 tons in 1910, were recovered from the bottom of Susquehanna River by dredges.

In the bituminous regions the principal use of washeries is to improve the quality of the slack coal used in the manufacture of coke by reducing the ash and sulphur, although considerable quantities, particularly in Illinois, are washed in the preparation of sized coal for household use. The quantity of bituminous coal washed at the mines in 1911 was 12,543,114 short tons. The washeries yielded 10,999,481 tons of cleaned coal and 1,543,633 tons of refuse.

J. G. White & Company, Incorporated, to Organize Two New Corporations.

The board of directors of J. G. White & Company, Incorporated, announces that two new corporations will be formed—one to be known as the J. G. White Engineering Corporation to take over the engineering construction department of J. G. White & Company, and the other to be known as the J. G. White Management Corporation, to take over the operating department of J. G. White & Company.

The total authorized capital stock of the J. G. White Engineering Corporation will be $2,000,000, divided evenly between the common and preferred stock. All of the common stock will be issued to J. G. White & Company, Incorporated, in return for the good will, business contracts, plans, tools, engineering instruments and similar assets of its engineering construction department, which are to be transferred to the Engineering Corporation.

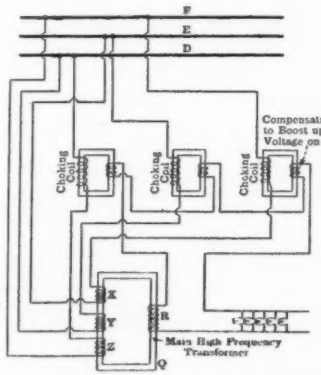
J. G. White & Company, Incorporated, will subscribe $500,000 of the preferred stock at par. The other $500,000 will be issued as the directors of the Engineering Corporation may consider advisable, and of the preferred stock subscribed for by J. G. White & Company, $350,000 will be offered to its present stockholders at par, each stockholder having the right to take such preferred stock to the extent of 10 per cent of the par value of his present holding of preferred and common. The balance of $500,000 subscribed by J. G. White & Company and not taken by its stockholders will be offered to directors of the new corporation or others who seem to be desirable shareholders. With the preferred stock thus issued a bonus will be given of the common stock of J. G. White & Company amounting at par to 10 per cent of the preferred stock subscribed for.

The authorized capital stock of the J. G. White Management Corporation is to be $1,000,000, of which $500,000 is to be common stock and $500,000 seven-per-cent cumulative preferred stock. All of the common stock will be issued to J. G. White & Company in return for the good will, etc., of its management department. J. G. White & Company will subscribe for and participate in the stock interest in the Management Corporation as indicated with the Engineering Corporation.

The meeting of the stockholders is called for December 10, 1912, and by this time it is expected that all proxies and subscription blanks will have been received.

Tripling the Frequency.

In a letter to the London *Electrician*, A. M. Taylor has called attention to a modification of the method used by F. Spinelli, and described in our last issue for converting three-phase into single-phase current of triple frequency. Mr. Taylor at first tried Professor



Connections for Triple Frequency.

Spinelli's arrangement but has modified it for another which he considers cheaper in first cost and more efficient, and for this he has made patent application. He points out that magnetic fluxes traversing the central limb of the transformer must contain harmonics of the third or higher orders. It is clear also that if the electromotive forces applied to the three outer windings contain no such harmonics the fluxes will approximate pure sine curves, the principal effect of high saturation being to cause the current in these primary windings to have a very sharp peak. In Mr. Taylor's arrangement this peak of current is utilized by being conducted through a separate unsaturated transformer. In Professor Spinelli's arrangement the departure of the flux from a sine variation can only be due to the resistance drop in the primary windings.

In Mr. Taylor's arrangement the primary current which excites the saturated core is also led through the primary windings of an unsaturated transformer, and in this full effect of every change of the primary current is obtained in the secondary current. The connections for these various coils are shown in the accompanying illustration.

New Electric Power Stations for the Rand, South Africa.

The new electric power station of the Victoria Falls & Transvaal Power Company, now nearing completion on the Vaal River at Vereeniging, is the fourth of the large power stations to be erected by this company in the Transvaal for supplying electric power to the mines and other industries of the Witwatersrand. This new station is near the railway bridge which joins the Transvaal and Orange Free State. It is expected that this will eventually become one of the largest of the generating stations operated by the company and, for that matter, one of the largest in South Africa. The *South African Mining Journal* contains a description of this new power station, the following being some notes therefrom:

The plant being laid down comprises two boiler houses, each containing 10 Babcock & Wilcox marine-type boilers, each capable of evaporating 36,000 pounds of water per hour and supplying steam at 220 pounds pressure, superheated to 350 degrees, to four A. E. G. Curtis turbo-alternators. Two of the latter are rated at 12,000 kilowatts and the remaining pair at 18,000 kilowatts, generating at 5,000 volts. The situation at Vereeniging, some 35 miles south of the Rand, being determined by the proximity of an ample water and coal supply—the two essentials of a power station—there is necessitated a considerable transmission scheme to bring the power up to the Rand. For this purpose the pressure is stepped up to 80,000 volts each set having its own transformer, and transmitted by duplicate overhead lines hung by means of suspension insulators from lofty steel towers, the spans being approximately 480 feet, and is protected at both ends by the latest devices for warding off the effects of lightning and kindred troubles. The switches controlling the lines are placed two in series with a resistance inserted according to the best modern practice, and are electrically operated by remote control. The lines, which are already practically completed, are connected onto the company's system at Robinson compressor station, where a new 80,000-volt transformer house has been erected. There the pressure is again transformed for distribution, being paralleled with the existing extensive network all along the Reef. It is expected that the new station will be supplying power in a few months.

Storage Batteries Discussed in Chicago.

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, held on the evening of November 25, two papers relating to storage batteries were presented and discussed. The meeting was presided over by Ernest Lunn, who before introducing the speakers called attention to the great advance in storage-battery practice in the last 15 years.

J. L. Woodbridge, chief engineer of the Electric Storage Battery Company, presented a paper entitled "Economic Application of the Storage Battery." This paper was illustrated with numerous lantern slides and dealt chiefly with use of the lead storage battery in such installations where it would improve the economy of the system. Mr. Woodbridge dwelt particularly on the application of the battery to carrying peak loads in railway power systems. He described several types of carbon-pile regulators for automatically controlling the excitation of the booster used with the battery; first was one of very simple form governed by a spring and series coil; the second was a form to make the battery take only sudden fluctuation; the third form referred to was one with a special stop device to prevent an overload on the generator; and the fourth form was one that embodied a device to limit the battery discharge current but that would avoid opening the battery circuit.

The case of an electric railway plant in a city of some 500,000 inhabitants was cited and the saving effected by using storage batteries for carrying the tops of the peaks was analyzed and shown to be a very decided means of improving the economy of the system. The development of the electric railway system of that city was described and illustrated. The part that storage batteries have played therein was clearly pointed out. In several cases the batteries were employed to improve the voltage regulation at the ends of distant feeders and to carry peak loads of the system. They were also employed as auxiliaries to the power-plant equipment and several are installed in substations. Peak-load service is the most important use of batteries in a number of other large railway systems cited.

In all cases where a transportation company buys its power from an electric generating company on a contract involving maximum demand and load-factor, the storage battery is a highly useful and economical means of reducing the peaks and therefore the demand charges.

A paper entitled "The Edison Storage Battery" was then presented by H. H. Smith, electrical engineer of the Edison Laboratory. In this paper Mr. Smith first referred to the invention and development of the Edison battery; Mr. Edison wanted to produce a storage battery that would put the horse off our city streets. After some three years of experimentation the first nickel-hydrate battery was invented in 1901. Several years of development elapsed before this battery was put on the market in 1904. Within a few months after this, it was found that this first commercial battery did not fully bear out its expectations and it was therefore withdrawn and the factory shut down. Further experimentation and development took place and the present type of the Edison storage battery was placed on the market in 1908. Many of the latter batteries have been in continual service for the last four years and recent tests of these equipments show them to be practically as good as when they were placed in commission. The actual useful life of the battery is unknown, as no tests, even of severe and prolonged nature, have yet revealed any material depreciation.

Mr. Smtih described in detail the construction of the positive and negative plates and with the aid of numerous illustrations showed how these are manufactured in the factory, how the containing cell is made and how the battery is assembled. He described the characteristics of the battery and showed its typical curves. The capacity-weight ratio is from 13.5 to 16 watt-hours per pound of cell. Mr. Smith recounted a number of very severe tests that have been imposed to prove the ruggedness and durability of the battery. Impurity in the electrolyte is probably the most serious injury that can be imposed upon it; therefore, replacement of water of evaporation must always be with distilled water. He referred to a battery that had been dropped into the sea and submerged for some four days; on being shipped back to the factory the salt water was thoroughly washed out, fresh electrolyte placed therein and the battery tested; after a few discharges it was found to be up to rated capacity and evidently none the worse for its experience. Prolonged short-circuits have been imposed on the battery without appreciably affecting its permanent capacity or performance. Excessive heating, while it affects the battery temporarily, does not produce permanent harm; a battery that passed through a fire was referred to and it was found that no permanent injury to the element itself had resulted. Low temperatures do affect the capacity of alkaline batteries, but little difficulty has been experienced in keeping the battery compartment so insulated against the cold that the critical battery temperature is not reached. A number of vehicle batteries have been in use in Winnipeg, Man., which gave excellent performance during the very severe weather of last January.

Referring to the uses of the Edison battery, Mr. Smith pointed out that it has heretofore been employed chiefly in vehicle service, both for the propulsion and lighting of electric vehicles and for the ignition and lighting of gasoline cars. Street cars have been equipped with it and operate very satisfactorily. A multiple-unit train equipped with batteries has recently been shipped to Cuba. Mining locomotives operated by the Edison battery are giving good service. The battery has also been used for railroad-train lighting and has given no trouble even during the coldest weather. The battery is being installed in some isolated plants, this being the first use of it for stationary service.

A discussion that was lively at times followed the presentation of these two papers. Among those who participated in this were P. B. Woodworth, G. H. Atkin, R. F. Schuchardt, E. H. Freeman, R. Macrae, T. Milton, R. H. Rice, G. W. Cravens, A. Scheible, Professor Wilcox and the authors of the two papers. Mr. Woodbridge, in closing, called attention to the purpose of his paper, which was not to cover the entire field of usefulness of the lead storage battery but merely to point out some applications in which economy is the predominating requirement. The remark by one of the speakers that the lead and alkaline batteries had each its own special field of usefulness certainly did not apply to the lead battery, because it has been, and will continue to be, used for every conceivable purpose to which a storage battery can be applied. In central-station service storage batteries were first employed to carry peak loads. Later it was found that they had considerable stand-by value which was of extreme importance in maintaining continuity of service. This led to confining the use of stationary batteries to stand-by use in these plants. Renewals of the lead battery, being usually made with the most recent types of plates, keep up the battery to the latest standard of practice. In many cases eight per cent covers depreciation, maintenance, insurance and taxes. He referred briefly to the ability of the lead storage battery to sustain heavy short-circuits; formerly such conditions meant buckling of the plates, but with modern plate construction no trouble is experienced from this

source. The danger from short-circuit is not so much to the battery itself, but to the external circuit, which was illustrated by a case where a monkey wrench had been dropped across the cell terminals and completely disappeared in vapor from the resulting "short."

Mr. Smith, in closing the discussion of his paper, also referred to the short-circuit performance of the Edison battery. He admitted that the alkaline battery has a somewhat higher internal resistance, which tends to limit the short-circuit current, but the ability to withstand repeated short-circuits is characteristic of the Edison battery alone. He also referred to its ability to withstand fire and explained why the rating was based on the five-hour discharge. Some consideration has been given the use of the Edison battery for operating the proposed electrified Chicago railway terminals. The gases given off in charging the Edison battery are oxygen and hydrogen; a small trace of the alkaline electrolyte is also carried off by the bubbles of gas, but this is not nearly so corrosive as the acid fumes from the lead battery. The electrolyte is potassium hydrate to which a very small amount of lithium hydrate is added; the latter has been found to have a most beneficial effect in prolonging the life. The critical temperature of the electrolyte below which the Edison battery gives a very much reduced capacity is between 40 and 50 degrees Fahrenheit. However, little difficulty is experienced in keeping the internal temperature of the cell above this value.

Electrification of Denver and Rio Grande.

Edward L. Brown, vice-president and general manager of the Denver and Rio Grande Railway, gave out a statement upon his recent return to Denver from New York City, saying that the company is contemplating the electrification of its railroad between Denver and Salt Lake City. Although no definite action has been taken, Mr. Brown stated that figures which have been submitted by the engineers of the General Electric Company, who are looking over the situation, make the project almost an assurance. A large corps of engineers will be put on the work of estimating the cost of the proposed change from steam to electricity in a few weeks, and if the figures when presented in more concrete form show a saving over the present method of operation, electric locomotives of the General Electric type will be installed.

The first section of the road to be electrified will be between Helper, Utah, and Salt Lake City, a distance of 115 miles. Figures have been submitted for the electrification of that part of the road between Minturn and Salida, Colo., crossing Tennessee Pass. Other units will be added from time to time until the entire mountain division is electrically operated.

Power for operating the locomotives will be furnished by the Utah Utilities, a company recently formed by the merging of the Utah Power Company, the Telluride Power Company and several other smaller hydroelectric plants in Utah, and capitalized at $52,000,000. The Central Colorado Power Company, it is said, will supply the energy for the Colorado division.

The cost of the improvement and equipment will be in the neighborhood of $6,000,000 and the railroad company expects to have the new locomotives in operation by July 1, 1913.

BOOK REVIEWS.

"The Principles of Parallel Projecting-Line Drawing." By Alphonse A. Adler. New York: D. Van Nostrand Company. Cloth, 66 + 26 pages (5¾x8¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This volume by one of the instructors at the Polytechnic Institute of Brooklyn is doubly interesting in its contrast with the closing section of the "Practical Descriptive Geometry" by W. G. Smith of Armour Institute. Both authors have recognized the practical importance of isometric projection, but Professor Smith follows the usual practice of leading up to this part of his course by developing descriptive geometry through problems of points, lines and planes. On the other hand, Mr. Adler begins with the parallel projecting-line drawing, of which isometric projection is the best known type, thereby enabling the student to get early practical results. Undoubtedly this beginning with the isometric drawing will hold the interest of students who would be bored and discouraged while trying to wade through the theoretical examples which usually come first in courses on descriptive geometry.

Such an inversion of the usual order ought to make the work appeal particularly to the class of men attending evening schools, for whom the volume is evidently intended. Even if the pupil never goes further into the general subject of descriptive geometry, his ability to depict objects by the parallel projecting-line method (making a single drawing serve the purpose of the usual plan, front elevation and side elevation) should prove a decided help to him in his work later on.

Perhaps it would be still more helpful if it taught the pupil how to use the isometrically ruled sheets and tablets now on the market for pencil sketches. So also, some of the simple rules laid down in Professor Smith's treatment of the same subject impress one as much more easily grasped and more easy of reference than Mr. Adler's explanations of similar problems. However, the latter's volume covers a good deal more ground, includes a wide range of practical problems and should prove an admirable guide for classroom instruction.

ALBERT SCHEIBLE.

House Wiring. By Thomas W. Poppe. New York: The Norman W. Henley Publishing Company. Paper, 100 pages (4½x6½ inches), 74 illustrations. Supplied by the Electrical Review Publishing Company, for 50 cents.

This little book is devoted mainly to the wiring of houses which have been completed and put into use before the wiring is begun, and the author seems to have had buildings of the residence type especially in mind throughout the discussion. The first of the seven short chapters which make up the book deals with such matters as the best arrangement of outlets, switches, etc., in residence wiring, and also contains some mention of the consideration which must be given quantities like voltage drop and current-carrying capacity in laying out a circuit. Then there follows a chapter on the installation of flexible conduit and steel-armored cables in finished buildings. The author's treatment of this subject, while not especially comprehensive, is quite practical and very explicit as far as it goes. In view of the now extensive use of this sort of wiring in finished buildings, the chapter is very much worth while. The next few pages are devoted to methods of installing rigid conduit in already built houses, and then there come several pages on the best ways of combining flexible and rigid conduits where the conditions are such as to make the use of both kinds of tubing in the same installation desirable. The remaining 25 pages of the book touch briefly upon the proper methods of grounding conduit work, the arrangement of circuits for the remote control of incandescent lamps, and upon certain features of knob-and-tube wiring. The book gives evidence of having been carelessly edited, and contains a number of assertions which are unfortunate for their lack of accuracy; such, for example, as the statement on page 27, that "the wire itself consumes some current in resisting the flow of current, etc." On the whole, however, the subjects which the author essays to discuss are handled in such a manner as to make the treatment of value to the electrician who is not familiar with what is best in modern wiring practice. To such electricians the book is worth the price, and more.

New Electrical and Mechanical Appliances

An Electrical Process of Washing Clothes.

Considerable interest has been aroused among laundrymen in the last few months by a process of washing clothes by means of electricity, by which the time and soap necessary are greatly reduced.

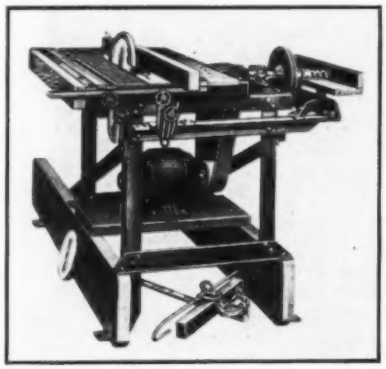
The National Laundry Machinery Company, Dayton, O., has recently been issued patents on a greatly improved washing machine. It consists of an electrode-equipped machine wherein clothes may be washed, bleached and disinfected by means of a current of electricity of any standard voltage. A terminal electrode is placed on the inner side of each end of the outer receptacle of the machine and to these the service wires are attached. To each head and to all partitions of the inner revolving cylinder, known as the "wheel," a circular electrode is attached. This is made circular in order that some portion of it will at all times be immersed in the washing fluid. Each inner electrode consists of two flat rings, one on each side of the partition or on each side of the cylinder head, bolted together, the bolts serving as electrical connections and as a means of holding the electrodes in position.

These inner electrodes have no electrical connections other than the washing or electrolyzing fluid. Therefore, one ring of each electrode acts as a cathode and the other ring as an anode. Since on a cylinder of only one compartment there would be two pairs of inner electrodes, there would be three electro-chemical reactions taking place instead of only one reaction were the inner electrodes not used. If only two terminal electrodes were used, and at a voltage of 110, a current of two amperes were passed through, there would simply be the chemical reaction in the washing fluid caused by two amperes. But with the inner electrodes, at a voltage of 110 and two amperes, there would be the same reaction in each compartment between each pair of electrodes. Therefore, the total amount of the chemical reaction would be equivalent to six amperes in one compartment, but with an expenditure of 220 watts as in the former case. This not only makes an economical arrangement but a more efficient one regarding the results obtained through the gases liberated.

Motor-Driven Circular Saw.

The accompanying illustration shows a remarkably serviceable combination of woodworking machine made by the Parks Ball Bearing Machine Company, of Cincinnati, Ohio. This machine is driven by a three-horsepower, 60-cycle, 220-volt Westinghouse induction motor. The machine may be used as a circular saw, and also as a boring machine by means of an attachment. It is made in two sizes, light and heavy, the former suitable for driving by a three-inch belt, and the latter for a four-inch belt, the belt in each case running over a three-inch pulley and driving a saw 14 inches in diameter for ripping hard lumber.

The frame is made of heavy angle steel, strongly braced, with overlapping corners securely bolted together. A



Motor-Driven Saw.

long wooden base, with timbers on each side, greatly increases the steadiness of the machine, giving a larger foundation and distributing the strain over more floor space. Angle steel clips are provided on the timbers for bolting the machine to the floor.

The saw table is made of angle and channel steel ground to a uniformly level and true surface. The angle-steel side table affords a substantial support, on which to bolt wood extensions of any width or length for special work. The table is hinged at the back end so as to permit its being lowered or raised. It is provided with an adjustable depth cut having an opening for a 14-inch saw that will cut five inches deep.

The hardwood strip side of the saw is removable so that a 3.75-inch cutter-head can be used on a saw mandrel. The table is of sufficient width to permit the addition of a three-inch or six-inch pointer. The machine can also be supplied with a boring attachment which can be used for routing, mortising and turning rosettes. This consists of an adjustable sliding support to hold the material being bored and a chuck attached to the end of the saw mandrel. Holes are provided in the frame for this attachment which can be easily added after the saw has been installed.

The machines are designed for electric drive by motors of from 3 to 4 horsepower capacity. The motor shown in the illustration herewith is of the squirrel-cage type. This type is particularly adapted to use in woodworking plants because of the absence of any moving contacts and the entire elimination of any danger of fire from sparking. The motor requires absolutely no attendance, beyond an occasional oiling, and may be started or stopped from any point that is convenient to the operator.

Three-Phase Cable for 30,000 Volts.

In the primary distribution system serving the area in a neighborhood of Berlin, Germany, and supplied by the Berliner Elektricitats-Werke, a length of 200 kilometers of three-phase cable is operated at 30,000 volts. The cross section of each of the three conductors is 50 square millimeters. A paper insulation is used and this is covered with lead and protected with steel armor. Each copper conductor is composed of 19 strands each 1.84 millimeters in diameter. The insulation between the conductors and the lead sheath is 14.6 millimeters in thickness. The diameter inside of the lead sheath is 67.5 millimeters. The thickness of the lead is 3.6 millimeters and the outside diameter, 89 millimeters.

At 15 degrees the resistance per kilometer of each conductor is 0.35 ohm; the capacity 0.13 microfarad; inductance, 0.36 millihenry; the insulation resistance from 700 to 1,000 megohms.

At 30,000 volts the charging current amounts to 75 amperes and consumes 45 kilowatts, the power-factor being only 0.02. Of the total loss, about 5 kilowatts are due to dielectric hysteresis. The frequency is 50 cycles.

INDESTRUCTIBLE SQUIRREL-CAGE ROTORS FOR INDUCTION MOTORS.

By M. O. Southworth.

The squirrel-cage induction motor has long been recognized as the most substantial and reliable of any class of power apparatus. However, there has always been one detail of construction that has caused more or less trouble even in the best of designs.

Fig. 1.—Casting End Rings on Squirrel-Cage Rotors.

This detail is the joint between the rotor bars and the end rings. These joints, of which there are two to each bar, have to carry low-voltage currents of great volume, especially while starting, and consequently anything less than perfection at this point becomes the occasion of extreme local heating, sometimes followed by the ultimate rupture of the joint and perhaps such arcing and burning of the bars and end rings as to necessitate expensive repairs.

Various forms of screwed joints,

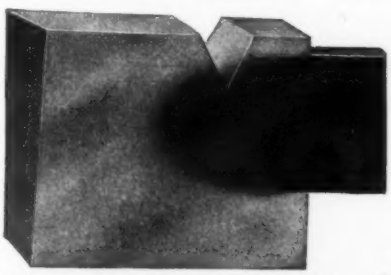


Fig. 2.—View Showing Fused Union of Rotor Bar and End Ring.

riveted joints and soldered joints have been employed with more or less success, but it has been known by engineers that so long as there was any joint at all between the bars and the rings, there were just so many points of possible failure under operating conditions of extreme severity and there has been no jointed-rotor construction which has not proved this by showing more or less failures at this point.

The solution of the indestructible-rotor problem then means a rotor without joints and this has been accomplished in the cast-on end-ring construction recently devised by the engineers of Fairbanks, Morse & Company, which is shown in the accompanying illustrations.

Fig. 1 shows the operation of casting so clearly that little explanation is required. The rotor bars are assembled in the core and the end rings of either brass or copper are cast around the ends of the bars. The treatment of the bars and the process used is such that a perfect fusion of each and every bar with the metal of the end ring is secured, and a "cage" is produced as solid and indestructible as if it were made in one piece. At the left of Fig. 1 the operation of casting the first ring on a rotor will be clearly seen, and at the right of the picture are two rotors upon which the first ring has been cast and the molds prepared for casting the second ring. This shows in a striking manner the fact that rotors thus prepared will hardly be subject to injury from any degree of heating that they will ever be subjected to in subsequent service. Fig. 2 illustrates the kind of fused union produced.

After casting, the rings are finished as shown in Fig. 3 and a deep groove cut into each ring down to the union of the bars and the rings, so that the integrity of each weld can be inspected. A rotor constructed in this manner may truly be called indestructible and the induction motor, by the invention of this process, has been given a longer life and a greater utility than ever before, since what has been the weakest point has now been made as strong as the rest.

Fig. 3.—Complete Rotor with Cast-on Rings.

New Push-Button Surface Switch.

The circular-base type of surface switch illustrated herewith has been added to the surface switch line made by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. This new switch is made in two styles, No. 7107 having a label-holder and No. 7108 having a plain cap without label-holder. The label-holder is of value where a number of switches are located together, each switch label indicating the circuit or lights it controls. The depth of this switch is only 1.75 inches and the diameter of the cover or cap, which is of polished nickel, is 1.875 inches. The circular base is the same as other surface switches but is hollowed out to make room for ends of circular loom or conduit.

One of the particular features of this switch is that there is no protruding button which may be broken off or by turning the wrong way be removed and lost. The ingenious mechanism of the Cutler-Hammer switch makes it possible to eliminate this rotating button and substitute the straight push-bar which is a part of the mechanism and cannot be removed and since it does not protrude cannot be accidentally knocked off as easily as the button. The push-bar has a light button at one end and a black button at the other. Pressing the light button means the circuit is closed. This is an advantage over the button operated switch, the button of which does not indicate by its position whether the circuit is closed or open. The rating of this new switch is 5 amperes, 125 volts and 3 amperes, 250 volts (National Electrical Code standard), the same as for the rectangular-base C-H surface switch for molding work. The bases of the latter switches are now made of a single piece in place of the two pieces used formerly.

Push-Button Surface Switch.

ILLUMINATION OF THE LAWYERS' CLUB.

By W. H. Spencer.

It is interesting to note the great improvement in the art of illumination and how ingeniously beautiful effects are produced with a low consumption of current and cost of maintenance.

This improvement is more noticeably evident in our modern hotels, clubs, restaurants and cafes, where attractive and novel illuminating effects form one of the main features of distinction.

Instead of ordinary equipment of chandeliers and brackets with their monotonous arrangement from parlor to pantry, the main rooms, such as the entrance corridor, lounging room, dining room, banquet room, etc., are given individual consideration in the detail of construction to provide for a scientifically and artistically designed system of illumination that will blend with the general scheme of decoration, combining the esthetic and utilitarian in a harmonious whole.

In the illumination of the Lawyers' Club, we find several features worthy of special attention. The main dining-room is lighted by specially designed silvered, rippled-glass-lined Frink reflectors, equipped with J-M Linolite tungsten lamps, which are particularly adapted for this kind of work; the light source being practically continuous, all spots and disagreeable shadows are eliminated; and with correctly designed reflectors, an evenly distributed light is obtained over the entire ceiling surface from whence it is diffused throughout the room.

In a dining room with this system of illumination the physical as well as the artistic, effect can be greatly improved by the use of shaded table lamps.

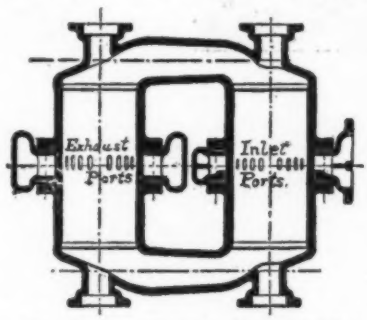
Special mention should be made of the wonderfully successful illumination of the large stained-glass window at the end of the dining room. This window is 20 feet wide by 22 feet high and is designed to emblematically represent the law periods from the Mosaic period to the present time. It is admirably executed in masterfully chosen colors and beautifully illuminated without any loss in color value and without any glaring light spots. An indirect system is used. The light flux is so evenly distributed over the diffusing background, that there is no apparent variation in intensity on any part of the window. The diffusing surface is specially tinted with pigments that absorb most of the yellow and red rays of the lamps, thus producing a remarkably realistic daylight effect. Specially designed Frink reflectors are used.

In the reading room excellent results are obtained by the use of Frink semi-indirect reflecting chandeliers, which are admirably adapted for this purpose. About 80 per cent of the light is reflected to the ceiling. The reflector is so designed, that the light is evenly distributed over the entire ceiling surface without a glaring light spot directly over the fixture. About 20 per cent of the light is diffused through an alabaster glass bowl in the bottom. A person can read with comfort and without eye fatigue while sitting in any position in any part of the room.

The lighting equipment described above was designed and executed by I. P. Frink, for whom the H. W. Johns-Manville Company, New York, is sole selling agent.

The Duplex Gas Engine.

A gas engine of entirely new design, which is being manufactured by Mather & Platt, of Manchester, England, was described by the inventor, A. E. L. Chorlton, at the autumn meeting of the Iron and Steel Institute. He said that the progress of the large gas



Cross Section Through Duplex Engine Cylinders.

engine had been retarded by lack of reliability and by high capital cost, and claimed that both these drawbacks were removed by the new design. The troubles experienced with the engine in the past had been mainly due to cracked cylinders and to failures in connection with the valves and valve-gear; in order to avoid these the castings must be as simple as possible, and valves should be dispensed with, as in the Oechelhaeuser engine. In the Duplex engine the cylinders are cast in pairs, with connecting passages at top and bottom forming combustion chambers, while the inlet ports are arranged around the middle of one cylinder, and the outlet or exhaust ports around the other. Long pistons are used, which open the ports first from one end and then from the other, the engine being double-acting; and the piston controlling the exhaust ports is set to move slightly in advance of the other. Gas and air are forced into the cylinders by a pump.

The engine works on the two-cycle system, as follows, calling the cylinder with the inlet ports No. 1, and the other No. 2. A charge is fired in the common combustion chamber at one end of the pair of cylinders, and the pistons are simultaneously propelled in the same direction. At about 0.8 of the stroke, the exhaust ports of No. 2 cylinder are uncovered by its piston, and the products of combustion are released. At about 0.9 of the stroke the inlet ports of No. 1 cylinder are uncovered by its piston and a flush of air alone rushes in, scavenging out the burnt gases. Immediately afterwards, the piston in No. 2 cylinder, on the return stroke, covers the exhaust ports, while gas and air are pumped into No. 1 cylinder through the inlet ports, filling both cylinders and the common combustion space at the end. The piston in No. 1 cylinder then closes the inlet ports, and both pistons compress the charge between them; ignition follows, and expansion as before.

Every stroke is a driving stroke, and the engine is double-acting. Hence it follows that the greatest possible output is obtained from a given pair of cylinders, as in the steam engine. The cylinder castings are of the simplest possible character, being free from valve pockets, thick flanges, or other awkward sections likely to cause cracks at high temperatures. There is not a mushroom valve on the whole engine, and there are no valves at all that are exposed to hot gases. The water jacket consists of a tank, into which the cylinders are lowered bodily, so that perfect circulation of the water and freedom of access to every part are ensured. Thus it will be seen that the troublesome features of the ordinary types of gas engine are entirely absent.

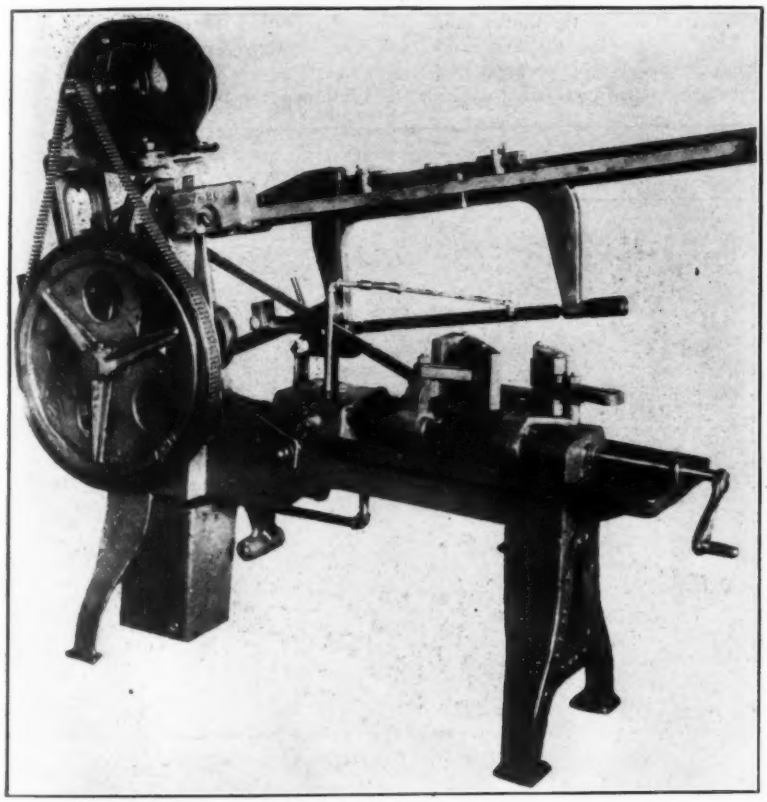
The makers have built five of these engines, three of which have been running for some time, day and night, driving a large plant; they propose to manufacture the Duplex engines in powers up to 4,000 brake horsepower, and larger if required. Mr. Chorlton sees no difficulty in building them up to 16,000 horsepower, with six cylinders, each 48 inches in diameter and 4 feet stroke, at 125 revolutions per minute. The vertical type has been adopted, in order to save both capital cost and floor space; Mr. Chorlton states that the cost is 20 per cent less than that of the large horizontal gas engine. As regards reliability and maintenance, his twin engine has only four moving parts exposed to high temperatures, as compared with 20 in a twin tandem four-cycle horizontal engine of equal power. The Duplex engine can run at a higher speed, owing to the absence of valves, and as in

this type the heat in the exhaust is large relatively to the volume of the jacket water, there is a greater opportunity for recovery of waste heat by passing the gases through a boiler fed with water from the jackets.

Altogether the engine is of more than ordinary interest, and may become of considerable importance to electrical engineers.

Electrically Driven High-Speed Hack Saw.

A high-speed hack saw, in which the length of the stroke is automatically regulated by the size of the stock held in the vise, is one of the lastest devices to which Crocker-Wheeler electric drive has been applied. This metal-cutting machine, known as the No. 7 Kwik Kut, is manufactured by E. C. Atkins & Company, of Indianapolis, Ind., and is so constructed that practically the entire blade is utilized at each stroke, regardless of the size of stock, and without attention or changing the machine by hand. This is a distinct advance over the standard length of stroke of about six inches adopted for most machines in which the length of the stroke can be changed only by hand.



High-Speed Hack Saw.

The cutting capacity of a power hack-saw machine is determined by the travel of the blade and the weight of the saw arm. The gain due to the full stroke of the blade automatically obtained in this machine varies from at least 25 per cent on the largest sizes to 100 per cent on the small sizes. This also results in a great saving in the use of blades as the wear on them is distributed over a greater area. The saving in the use of blades is further increased by employing a simple device by means of which the blade is slightly raised on the return (non-cutting) stroke, thus avoiding unnecessary wear which dulls the teeth. This device consists of a friction grip working on a heavy upright bar adjusted by a counterbalancing weight.

For the purpose of increasing the speed and at the same time avoiding burning the blade, this machine is provided with a complete and efficient lubricating system, consisting of pump, tank, pipes and catch basin. If required to cut at an angle, the machine is furnished with a swivel vise, so constructed that material can be cut at any angle up to 45 degrees. Otherwise the machine is supplied with a solid vise which saves loss of blade travel. The machine is also provided with an automatic stop, an outside rest which holds the stock until the cut is complete, and a special depth gauge which provides for automatically stopping the saw at any desired depth in the cut.

The Crocker-Wheeler motor which is used to drive this machine is a one-half horsepower, 230-volt, 550 to 1,100 revolutions per minute direct-current machine resting on a special bracket. The motor is connected with a patented silent chain, running over hardened tool-steel gears. The speed is controlled by a regulator attached to the motor bracket, which enables the operator to run at any speed desired from the minimum of 50 strokes per minute up to 100 strokes by small gradations.

An Improved Steel Coupling For Shafts.

A new form of flexible coupling made entirely of crucible cast steel, and to dimensions especially suitable for this material, is being introduced by McEwen Brothers, Wellsville, N. Y. This McEwen coupling, as it is called, is said to have the smallest diameter and mass, and therefore the smallest inertia, of any truly flexible coupling on the market.

The keys extend clear through the shafts, are set at right angles and are arranged to permit a marked degree of misalinement, yet because of ample key bearing surface and the exceptionally good lubrication from packing of heavy or soft grease, there is no noise or tendency toward serious wear.

The design is particularly good for withdrawals parallel to the shaft axis and very small clearance is required for removing any part.

This type of coupling was first used and has been given its severest test upon pumps direct-connected to steam turbines running 24 hours per day for months at a time.

The satisfaction which it has given under these high speeds and other severe conditions, as reversible motor drive for machine tools, would seem to indicate a general usefulness for blower, rotary pump, motor, generator and turbine and line-shaft connections, and on other machinery of any speeds.

New Testing Transformer for University of Illinois.

The Department of Electrical Engineering of the University of Illinois has added to its equipment a 200,000-volt testing transformer made by the General Electric Company. It will be used in studies of corona and other phenomena of high-tension lines, the determination of the breakdown point of oil and of porcelain insulators, and in a study of the action of lightning arresters and other protective apparatus.

In the United States there are twice as many miles of telegraph lines as in any other country of the world.

Tungsten Replacing Nernst and Carbon Lamps in Large Store.

What is claimed to be the largest retail store in the world, the immense establishment of Marshall Field & Company on State Street, Chicago, is gradually replacing its Nernst and carbon-filament lamps with tungsten lamps. Within a few months all the older lamps will have been replaced. The Nernst lamps were introduced in this store in 1907 and were used for general illumination in most of the sales departments. Two and three-glower lamps were chiefly employed, the total number of glowers being about 11,000. These are being replaced with about 6,000 tungsten lamps ranging from 60 to 250 watts; these are used in the same fixtures equipped with diffusing globes of light and in some cases dense opal. At the same time about 20,000 carbon lamps used for local and special lighting are being retired for their decidedly more efficient tungsten rivals.

Sealed Shipping Cartons for P. & S. Electrical Specialties.

Some difficulty has been experienced by manufacturers of small electrical supplies and specialties from tampering of shipments before their arrival at the place of destination. An effective way to check this trouble has been inaugurated by Pass & Seymour, Incorporated, of Solvay, N. Y., and will be employed in all shipments made by this firm.

P & S Shipping Carton with Seal.

This new method is made clear by the typical illustration herewith, which shows a neat and strong pasteboard carton containing 25 number 90 chain-pull sockets. Around the center of the box is a band that serves as a seal placed thereon so that the customer can readily determine whether or not the box has been opened or tampered with.

In filling standard-package orders it saves him the time required to open the box to see whether some one has removed any of the contents. If the seal is intact he knows that the box contains the quantity called for by the label.

Motor-Driven Air Compressor for Torpedo Service.

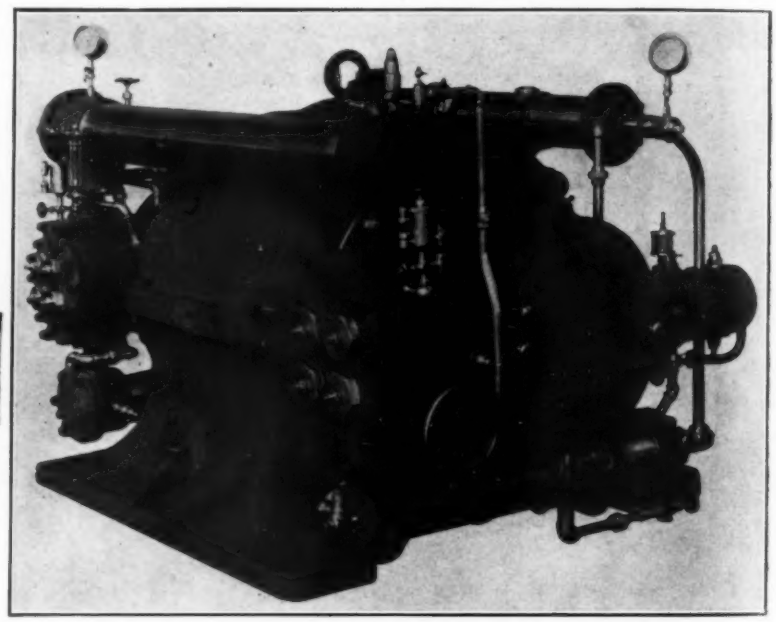
The accompanying illustration shows a self-contained motor-driven air compressor furnished to the United States Government for use on battleships in connection with torpedo service.

The compressor built by the Platt Iron Works, Dayton, Ohio, and designed by R. E. Allgire of that company, is of the four-stage single-acting piston type, all cylinders and auxiliary receivers being mounted on the motor frame. The first and fourth-stage cylinders are mounted on the commutator end of the motor, the second and third-stage cylinders on the opposite side, counter-balanced cranks being provided on each end of the motor shaft.

The air entering the first-stage cylinder at atmospheric pressure and temperature is compressed to about 42 pounds pressure and passes thence to the first-stage cooler. In the following stages the air is compressed to approximately 225,875 and 2,500 or 3,000 pounds per square inch, respectively, it being cooled each time to practically atmospheric temperature in the coolers through which it passes in going from one cylinder to the next. The highest temperature reached in the whole operation is not more than 290 degrees Fahrenheit. The compressor cylinders, of course are supplied with water jackets which help to preserve low operating temperatures, the water being maintained by an attached pump of the rotary type which is driven direct from the main shaft.

Careful attention has been given to the lubrication of the machine, both the splash and forced systems of lubrication being employed. Drains are provided for renewing of the oil, and for drawing off any water that may have gotten mixed with the oil. Provision is also made for draining the coolers of each stage, and for removing all cooling water from the cooling system in case the machine be allowed to stand idle in an exposed position where there is danger of the water's freezing.

The electric motor for the compressor was furnished by the Fort Wayne Electric Works. It is of the semi-inclosed type (in fact, almost totally inclosed) and is designed to carry its full rated load of 80 horsepower, continuously, with a speed of 500 revolutions per minute when operating on 125 volts, direct current. The motor is especially designed for the service, the armature being pressed upon the compressor crank shaft, the bonnets arranged to accommodate the mounting of the compressor parts, and the base being especially heavy to insure stability of the unit. The frame is divided horizontally to facilitate disassembling without removal of all of the compressor parts.



Compact Motor-Driven Air Compressor for United States Navy.

The compressor and motor showed up remarkably well on the official test, delivering considerably more than the required 50 cubic feet of air per hour at 2,500 pounds per square inch pressure, when running at rated speed. The compressor also easily met the requirements of one-half hour's service at 3,000 pounds pressure without undue heating, vibration, wear or trouble of any kind.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

LYONS, IOWA.—An agitation has been started for cluster lights on Main Street. C.

DALLAS, WIS.—J. A. Anderson contemplates installing an electric light plant here. C.

LENNOX, S. D.—The Council is considering arrangements for an electric light plant. C.

MILLER, S. D.—Funds have been raised for installing 12 cluster lights along Broadway. C.

GREEN BAY, WIS.—Business men on West Walnut Street contemplate installing cluster lights. C.

NORWALK, WIS.—Bonds have been voted for installing an electric light system at this place. C.

FREDERICKSBURG, IOWA.—The town has voted $4,500 bonds for installing an electric light plant. C.

MONTGOMERY, MINN. — The McKaskey Company will erect an electric light plant and power house.

NEW ROCKFORD, N. D.—The Council is considering ways and means for providing an electric light plant.

HUDSON, IOWA.—This town has voted a franchise for an electric light plant. Work is to be started immediately.

BRECKENRIDGE, MINN.—The City Council and Light Commission are considering installing a "White Way." C

DALLS CENTER, IOWA.—The city has voted to grant a franchise to the Adel Mill Company for electric lighting. C.

KENYON, MINN.—The Village Council has granted the Consumers' Power Company a 25-year electric lighting franchise in Kenyon.

TERRY, MONT.—There is agitation for an electric light plant. The council will grant a franchise for that purpose. C.

ARMSTRONG, IOWA.—P. H. Atwood contemplates installing an electric light plant in connection with the tile factory. C.

NEW PROVIDENCE, IOWA.—The town has voted a franchise for electric lights to the Iowa River Light & Power Company. C.

PUYALLUP, WASH.—A committee has been appointed to investigate the feasibility of installing a municipal power plant.

BUCK GROVE, IOWA.—Negotiations are under way to install a local electric light plant, to be operated by a gasoline engine. C.

SILVERTON, ORE.—The Fortland Railway, Light & Power Company has been granted a 25-year electric-light franchise in this city.

STOCKTON, CAL.—The Oro Electric Company has applied for a franchise here. Bids for the same will be received until December 17.

HUMISTON, IOWA.—The town has voted to grant a franchise to the Leon Electric Company. The company will build a transmission line here. C.

BELLE PLAINE, MINN.—The local electric light plant will purchase a 25-horsepower single-phase 875 revolutions per minute motor for driving a pump.

NIANTIC, ILL.—Residents of the village are contemplating the installation of an electric light plant. Power may be furnished by the Illinois Traction System. Z.

FRANKFORT, KY.—The installation of up-to-date street-lighting standards will proceed along main and St. Clair Streets in this city in the immediate future. G.

ARLINGTON, S. D.—The City Council has completed arrangements for installing an electric light plant. Contracts will be awarded at the next meeting of the council. C.

SAN DIEGO, CAL.—Canadian capitalists represented by T. H. Wilson, of Vancouver, B. C., are reported to be arranging for the establishment here of a large power plant.

LOUISVILLE, KY.—It has been announced that the organ factory of Henry Pilcher's Sons will be completely equipped with individual motors early in the spring of 1913. G.

ROSWELL, N. M.—The Council has approved a plan for boulevard lighting to take the place of the present arch system and indications are that work will soon be started.

HOPKINSVILLE, KY.—Plans are being completed by the Hopkinsville Business Men's Association for the installation of modern lighting equipment along Ninth and Main Streets.

SEATTLE, WASH.—The Pacific Coast Light, Power & Railway Company has been incorporated with a capital stock of $500,000 by Albert L. Robinson, I. N. Robinson and K. E. Robinson.

WINCHESTER, KY.—This city is preparing to make extensive improvements in the way of ornamental lighting standards about the Government Square, Court-house Square and business district. G.

CHELSEA, IOWA.—The Iowa Railway & Light Company was voted a franchise for electric lighting. The power will be transmitted from the Cedar Rapids and Marshalltown plants of the company. C.

INDIANAPOLIS, IND.—The I. & C. Light & Power Company has been organized as an auxiliary company to the I. & C. traction properties, with a capital stock of $900. The directors are the same as those of the traction company. Z.

MARCUS, IOWA.—A franchise has been granted to K. C. Gaynor, of Sioux City, to put in and operate an electric light plant, which will cost about $15,000. The work will begin soon if weather permits.

OGDEN, UTAH.—It has been announced that the Utah Light & Railway Company has selected the right of way for the new electric lighting line to North Ogden and that construction work upon it will be started immediately.

MILLEDGEVILLE, OHIO. — The Washington Gas & Electric Company will issue bonds in the amount of $100,000 and will erect a new power plant in Milledgeville and run a power line from Washington Court House here.

NEWPORT, KY.—Sixteen modern bronze street lighting standards are to be purchased and installed by the Newport City Council and will be operated by the Union Light, Heat & Power Company about Newport's public square. G.

NEWARK, N. J.—Property owners on Springfield Avenue have requested the Public Service Electric Company to estimate the cost of installing a flaming arc lighting system on that thoroughfare, such as now used in the center of the city. A.

LOUISVILLE, KY.—Announcement has been made that the Louisville Lighting Company may enlarge its power plant in 1913 to take care of an increased load. G. Wilbur Hubley is chief engineer of the company and will plan the improvements. G.

SALEM, MASS.—The United States Government has notified the Essex County Commissioners that they must equip all bridges under their jurisdiction with channel lights and it is estimated that this improvement will require an expenditure of $2,500.

LOUISVILLE, KY.—Plans are being prepared by the Seelbach Hotel Company, of this city, for the erection and equipment of a $50,000 addition to the Seelbach Hotel electric light and power plant at Fourth and Walnut Streets. The work is to be begun at once. G.

SYRACUSE, N. Y.—Frank W. and Marion E. Knapp and Sidney Slocombe of Marcellus are the directors of the newly organized Marcellus Lighting Company, a $10,000 corporation that proposes to supply light and power to the villages of Marcellus, Skaneateles and Camillus. The company will utilize Niagara power, and has completed a transformer station for this purpose at Marcellus Falls. At present the company will confine its work to furnishing light at Marcellus and a paper company's plant at Marcellus Falls.

CHICAGO, ILL.—The Northern Indiana Gas & Electric Company has announced its intention to begin work

immediately upon a new electric power plant to serve Hammond, East Chicago, Indiana Harbor, Whiting and 20 smaller cities and towns adjacent to them.

ROCK ISLAND, ILL.—Coal Valley Light & Power Company has been incorporated with a capital stock of $10,000 to operate electric light and power stations and plants. E. E. Walsh, Jr., H. M. Walsh and Paul Wagner are named as the incorporators.

MOUND CITY, ILL.—Mound City Light & Water Company has been incorporated with a capital stock of $100,000 to operate electric, water, ice and steam plants. The incorporators are H. E. Chubbuck, W. H. Carnahan, W. J. Achelpohl, E. W. Fowler and W. H. Creviston.

MADISON, WIS.—Mayor Heim will appoint a council committee to investigate the possibilities of obtaining electricity and power outside the city for municipal use. Securing power from the Southern Wisconsin Power Company's dam at Prairie du Sac is being considered. Z.

MIDDLETOWN, N. J.—The franchise granting the Middlesex & Monmouth Electric Light, Heat & Power Company permission for a pole line on Kings Highway, Middletown (Monmouth County), has been approved by the State Board of Public Utility Commissioners. A.

LOS ANGELES, CAL.—A special council committee has been appointed to open negotiations with the Southern California Edison Company and the Los Angeles Gas & Electric Company for the acquisition by the city of portions of their systems for a municipal distributing system.

MARTINSBURG, W. VA.—The Hedgeville Light & Heat Company has been incorporated with a capital stock of $1,000 for the purpose of operating a light and heat plant. The incorporators are W. E. Gordon, R. C. Miller, C. E. Dennis, J. E. Wyndham and Edward L. Hess, all of this city.

JANE LEW, W. VA.—The Jane Lew Light & Heat Company has filed articles of incorporation with a capital stock of $10,000 to manufacture power, light and heat. The incorporators are Harry Davisson, S. G. Jackson, Clarksburg, W. Va.; N. W. Mowrey, W. A. Jackson and Fred Flesher, of Jane Lew.

VIRGINIA, MINN.—The Mesaba Light & Power Company has been incorporated with a capital stock of $1,000,000 for the development of water power to supply light and power to range towns. The incorporators are J. P. Boyle, of Eveleth, Richard B. Sperry, of New York, and Arthur McMillan, of Chicago. Z.

ABILENE, TEX.—The Abilene Gas & Electric Company has been organized here with a capital stock of $275,000 for the purpose of installing and operating an electric light and power plant and the construction and operation of electric lines. The incorporators are E. T. Thomas, D. Dellis and Glenn A. Smith, all of Abilene. D.

PALMER, MASS.—A franchise has been granted to the Warren Power Company, Warren, Mass., to operate in Palmer. The company has water privileges at West Warren, which it proposes to further develop. The company has announced its intention to erect a large power plant to manufacture electricity which it proposes to furnish to Palmer and other towns.

CARILLON, QUEBEC.—The National Hydro-Electric Company, which is backed by Montreal capitol, has made application to the Dominion Government to develop water power sites at this city. It is estimated that there are available 160,000 horsepower of development. The plan is to transmit the current to the Montreal district.

CHICAGO, ILL.—The Middle West Utilities Company, which has been acquiring electric light and power plants throughout Kentucky, recently purchased the Elizabethtown Electric Light Company, of Elizabethtown, Harry R. Reid acting as agent. The newly acquired plant is to be extensively improved by its present owners.

VICTORIA, TEX.—The Victoria Manufacturing Company will double the capacity of its electric light and power plant and will also enlarge its ice manufacturing plant here. A steel turbine and an electric generator of 500-kilowatts capacity will be added to the equipment of the electric light plant. The proposed improvements of the company will cost about $40,000.

LIVINGSTON, ILL.—The Twin City Light, Heat & Power Company, this city, has been incorporated to furnish electrical energy to the villages of Livingston and Williamston, Ill. Power will be purchased from the McKinley System and distributed. D. E. Atlward, of Livingston, is president and the Dixon-Smith Engineering Company, of St. Louis, Mo., acts as consulting engineers.

NOBLESVILLE, IND.—H. H. Lawler, representing the Indiana Gaslight Company, which was recently incorporated by Chicago business men with $1,000,000 capital, is negotiating for an electric-light franchises in Noblesville and Tipton, where his company recently acquired the Noblesville Gas & Improvement Company and the Citizens' Gas Company, with the view to extending these plants to provide electric service. G.

HOUGHTON, MICH.—The Sturgeon River Company, a new organization composed of New York capitalists, plans to build an immense water power system, which will offer cheaper power to many of the Lake Superior copper mines. S. Prickett, of Sidnaw, Mich., is the promoter of this enterprise. A great dam will be constructed and equipment built for the generation of 20,000 horsepower. The transmission lines will run through Globe, and down along the line of the Copper Range Consolidated mines, to Portage Lake, from which point branches will be run to the various mines which may wish the power. Contracts for lighting cities and villages will also be the aim of this company.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

TYLER, MINN.—The Tri-State Telephone Company will establish a local exchange. C.

GARDEN GROVE, CAL.—The Home Telephone Company is preparing to install a system here.

PINE ISLAND, MINN.—J. P. Keane succeeds to the telephone exchange and will make improvements.

TAMPA, FLA.—It is reported that the Peninsular Telephone Company plans to install an automatic system here.

LAKEPORT, CAL.—The Lake County Farmers Telephone Association has been awarded a franchise in this city.

LOS ANGELES, CAL.—Bids will be received up to December 3, for the purchase of a franchise granting right to transmit electricity within the city for telephone and telegraph purposes.

OAKLAND, CAL.—Bids will be received up to December 2, for furnishing a combination central-energy private-branch exchange and police telephone and telegraph switchboard.

PERRY, IOWA.—The Hawkeye Telephone Company will install a complete new local system at a cost of $20,000 to $25,000. It will be a central-energy system. C.

SANTA ANA, CAL.—The Pacific Telephone Company is planning to expend about $6,000 after the first of the year in improvements on its system at Garden Grove.

FRESNO, CAL.—Residents and taxpayers have petitioned for the privilege of erecting telephone poles and wires along the county highway between here and Riverdale.

WILLARD, OKLA.—Pioneer Telephone Company has been incorporated with a capital stock of $5,000, by Guy D. Bulen, Yelton, O.; Nossman and George W. Thompson, of Willard.

MANVEL, TEX.—Suburban Gardens Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are T. E. Scott, W. B. Scott and W. R. Allison.

NASHVILLE, TENN. — Dicus Home Telephone Company has been incorporated with a capital stock of $1,500 by J. A. Carver, S. H. Carver, H. C. Clark, H. T. Tate and J. L. McCarver.

BUNCETON, MO.—Bunceton Independent Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are J. G. Powers, E. P. Harned, O. N. Dille and S. H. Groves.

LOUISVILLE, KY.—The Board of Public Safety has recommended to Mayor William O. Head that the system of police signal stations, electrically, operated, which has been begun in this city be extended. G.

NORTH CALDWELL, N. J.—The Board of State Public Utility Commissioners has approved an ordinance granting the New York Telephone Company permission for the construction of a line on Mountain Avenue. A.

DANVILLE, KY.—J. A. Sullivan, district manager of the Cumberland Telephone & Telegraph Company in Central Kentucky, has announced that a central-energy exchange will be installed by his company in the city of Danville. G.

NORTH ST. PAUL, MINN.—The Northwestern Telephone Exchange Company has started extensive improvements to its local system to cost $10,000 to $15,000. Cable will be installed in place of wires wherever possible. C.

WOODWARD, OKLA.—Willard, Rose Valley and Greenvale Telephone Companies, of Woodward, have been incorporated each with a capital of $525. The incorporators are C. L. Morrow, H. E. Anderson and John Harris, all of Woodward.

SEATTLE, WASH.—An Eastern expert has been engaged by the City

Council, of Seattle, to estimate upon the cost of establishing a municipal telephone system. It is the intention of the Council to submit the proposition to a vote on March 4, next.

CINCINNATI, O.—The Metropolitan Telephone & Telegraph Company has been incorporated with a capital stock of $10,000 to build a telephone line from Pennsylvania to Michigan. W. E. Hawley, J. W. Lanish, L. B. Stanley, John B. Chapman and N. I. Phelps.

CAMDEN, N. J.—T. B. McClain, district manager of the Delaware & Atlantic Telegraph & Telephone Company, announces that the company has appropriated $10,000 for extensions in its local underground conduit system, principally in the vicinity of Haddon Avenue, Crestmont and City Line.

DAYTON, WASH.—The Patit Telephone Company has been organized to build about 50 miles of telephone lines. Thomas Reed is president of the company; Walter Dunning, vice-president, and Elmert McCauley, treasurer. Elijah Walker, Roy L. McBride and Jesse Hatley are the directors of the company.

VIRGINIA, MINN.—The Range Telephone Company has filed articles of incorporation with a capital stock of $300,000. The incorporators are F. S. Colvin, J. S. Lutes, of Biwabik; P. R. Vail, Adelbert Trotter, H. O. Johnson, Andrew Grande, W. B. Shaver, Mark Elliott, A. C. Osborne, C. H. Rogers, and others.

ELECTRIC RAILWAY.

(Special Correspondence.)

SAN DIEGO, CAL.—The San Diego Electric Railway Company has been granted permission to establish a survey through Balboa Park of Brooklyn Heights.

PHILADELPHIA, PA.—It is reported that Philadelphia capitalists are planning an electric road to run from Reading to this city. Emanuel Thalheimer is said to be interested in the project.

GLENCOE, MINN.—It is reported that the Electric Short line which is now building a line from Minneapolis to Watertown, Minn., will build a branch from Watertown through Les-

TOMAHAWK, WIS.—The Marinette, Tomahawk & Western Railway Company has been incorporated with a capital stock of $25,000. The incorporators are R. B. Tweedy, C. H. Gundy, C. C. Uber, F. B. Werner and E. C. McNaughton.

DALLAS, TEX.—The Southern Traction Company is planning to extend its road south from Waco to Temple, a distance of 30 miles. It is said that this road will ultimately be continued south from Temple to Austin, another 70 miles.

BIRMINGHAM, ALA.—The Lookout Mountain Railway Company has filed articles of incorporation with a capitalization of $100,000 for the purpose of operating an electric railway from Gadsden to the top of Lookout Mountain, near Noccalulu Falls.

ST. PAUL, MINN.—It is reported that the regents of the University of Minnesota are negotiating with the Legislature for an appropriation with which to build a car line from the main campus to the Agricultural College, a distance of three and one-half miles.

CHICAGO, ILL.—Chicago & Northwestern Interurban Railway has been incorporated with a capital stock of $100,000 to build an interurban through the townships of Niles, Maine and Wheeling. W. A. Miller, F. W. Hockspeier, O. J. Smith, W. E. Swanson and G. L. Starbird are the incorporators.

ALTOONA, PA.—There is a movement on foot to build an electric railway line between Altoona and Patton and it is said that over $200,000 is in sight for this project, which is independent of the proposed extension and electrification of the Wopsononock road.

MONTREAL, QUEBEC.—The Farmers' Interurban Electric Railway Company has been organized with a capital stock of $1,000,000 for the purpose of building a line from River des Prairies to St. Anne de Bellevue. It is stated that incorporation papers will be presented at the next session of the Legislature.

SAN JOSE, CAL.—The San Jose Terminal Railway Company has been granted permission to issue $200,000 in bonds, to be used in the construction of an electric railway from this city to Alviso. The stockholders of the company are required to first raise $25,000 in cash through the sale of preferred stock.

PORTSMOUTH, N. H.—The New Hampshire Public Service Commission has granted the petition of the Boston & Maine Railroad Company for the right to extend its electric car line from Portsmouth to Greenland, N. H. The company asks locations from the Portsmouth City Council and the Selectmen of Greenland. W.

LITTLE ROCK, ARK.—The Arkansas Interurban Construction Company has been chartered with a capital stock of $500,000. W. H. Garanflo, Little Rock, is president of the company, and L. Garrett, Little Rock, secretary and general manager. The company will build an interurban between Little Rock and Hot Springs.

ONEONTA, N. Y.—The Oneonta & Eastern Railroad Company has been organized for the purpose of constructing a trolley road from Oneonta to Cobleskill, passing through the villages of Davenport, Davenport Center, Fergusonville, Simpsonville, Summit and Richmondville. W. D. Greenleaf, of Charlottville, is president of the company.

PARIS, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., through representatives of the Texas Traction Company, of Fort Worth, is investigating the proposition of constructing an interurban electric railway between Paris and Sherman. The proposed line would be about 60 miles long and traverse a thickly populated territory. D.

LAFAYETTE, LA.—The Louisiana Traction & Power Company has been incorporated with a capital stock of $250,000, with Lafayette as headquarters. The purpose of the company is to build and operate traction lines from Lafayette to the Sabine River and to Morgan City, Alexandria and Abbeville. J. A. Landry is president of the company and P. O. Moss, secretary.

LUMBERPORT, W. VA.—It is stated that the Monongahela Valley Traction Company has secured right of way in this city and will build the car line between Haywood and Lumberport soon. The new line will afford the much needed facilities of transportation for both freight and passengers in and out of Logansport and contiguous territory, which have heretofore not been enjoyed.

POTTSVILLE, PA.—It is reported here that a new trolley road, which will connect Pottsville and Shenandoah, will shortly be started. It is not known definitely who the promoters of this project are but are believed to be the North-of-the-Mountain people, who have been considering the construction of such a line for some time. Surveyors have been at work laying out the proposed route.

PORT ARTHUR, TEX.—The Fort Arthur Light & Power Company, which was recently organized with a capital stock of $600,000, has taken over the electric light and power plant of the Port Arthur Traction Company. It is stated that the new company will also provide power for the operation of the interurban electric line which is to be constructed between Port Arthur and Beaumont, 25 miles. D.

SALEM, MASS.—Counsel Coolidge of the Boston & Maine Railroad Company stated at a recent hearing that it is the intention to electrify that portion of the Portland division between Boston and Beverly within two years. The four-tracking of the roadbed and the elimination of grade crossings is now going forward. The single-track tunnel through Salem, long an anachronism in railroading, will be enlarged. W.

QUINCY, ILL.—The Mississippi Valley Traction Company has filed articles of incorporation at Springfield for the purpose of building an interurban line from Springfield to Quincy, connecting the important towns in intervening counties. The company is capitalized for $25,000 with the following directors: George M. Skelly and W. L. Campbell, of Springfield, Edward Cooper, of Kent, and J. T. Creogore, of Youngstown, O., as directors. Z.

ALTOONA, PA. — The Altoona Northern Railroad has been chartered with a capital stock of $600,000 for the purpose of building and operating a standard gauge line from Wopsonock to Patton, a distance of 12 miles. The present Altoona, Juanita and Northern railroad, known as the "Wopsy," will, be reconstructed into a standard gauge road, and the entire road from Altoona to Patton will be electrified and equipped in the most modern style, with all the safety appliances of a trunk line.

SAN JOSE, CAL.—The sale of bonds of the Watsonville Transit & Navigation Company to and the acquisition of the Monterey & Pacific Grove electric line by the Baltimore syndicate, represented on this coast by Patrick Calhoun, looms large in significance to the interest and prosperity of San Jose. These two transactions coupled with the extension of the power lines of the Sierra-San Francisco Power Company Corporation indicate with certainty the extension of the latter's rails from the present San Mateo terminus to San Jose and on to Monterey and Watsonville.

FINANCIAL NOTES.

The course of stocks during the week was highly irregular. Politics and the money-market conditions have been generally blamed, while the tariff is discussed with apprehension, though toward the end of the week a more optimistic feeling has become evident.

The Telluride Power Company, a Colorado corporation capitalized for $10,000,000 in stocks and the same amount in bonds, having holdings embracing several generating plants, reservoirs and transmission lines in the Telluride district, was recently merged with other Utah and Idaho power companies to form the Utah Utilities Company, a $52,000,000 corporation. The Telluride Power Company has transferred all its assets to a trustee and has been dissolved under the laws of the State of Colorado. The property was sold at public auction at Telluride, Colo., on Monday, November 18, to W. E. Wheeler, president of the Bank of Telluride, who was acting for Niel A. Withers. The purchase price was $6,460,000.

A Washington dispatch says negotiations are under way between Attorney-General Wickersham and the American Telephone & Telegraph Company regarding a friendly settlement squaring that corporation with the Sherman anti-trust law, as a result of an extensive investigation by Department of Justice of the operations of the company. The Attorney-General has pointed out several modifications which he considers necessary to bring it within compliance with the law as interpreted by Supreme Court in Standard Oil and Tobacco cases.

President Sunny's report shows Chicago Telephone stockholders and bondholders received only 19 per cent of gross revenue against 27 per cent by Chicago City Railway and Commonwealth Edison, 28 per cent by People's Gas and 34 per cent by Consolidated Gas of Baltimore. Chicago Telephone Company's gross revenue last year was 45 per cent above 1908, while expenses increased 54 per cent. He asserted that any telephone rate revision must be upward and intimated that Bemis was prejudiced in discovering the $700,000 surplus to apply to rate reductions. The two paramount questions are actual investment and proper depreciation. Dividend rate should be eight per cent upon company's appraisal.

Vice-President Brown, of the Denver & Rio Grande Railroad, announced that the first steps in electrifying the Denver & Rio Grande system are to be taken at once. The first unit to be electrified will be from Helper, Utah, to Salt Lake City, 114 miles. The second unit will be over Tennessee Pass, the great Continental Divide in Colorado, and will involve the electrification of the line from Salida to Minturn, Colo., a distance of 87 miles. The Utah work will be commenced early in 1913, and it is hoped that it will be completed by the time the new two-per-cent detour line over Soldier Summit is finished, in July of that year. The Utah Utilities Company is to furnish power for the Utah lines, and the Central Colorado Power Company will probably furnish the electricity for the Colorado lines. The improvements to be undertaken by the Denver & Rio Grande, the Central Colorado Power, and the Utah Utilities Company will aggregate between twenty and twenty-five million dollars, most of which will be expended during 1913 and 1914.

Today General Electric and to a lesser degree Westinghouse Electric are independent of the large-order customer. They sell to a legion of customers and in small individual orders. For instance, in its late year General Electric billed 388,520 individual orders, an average of $181 per order. In 1907 orders totaled but 235,028 and the average size of orders was $255, an increase of 65 per cent in number and 29 per cent decrease in size during the five years.

Westinghouse figures tell an even more emphatic story and for the reason that Westinghouse has within the last three years been going in more and more for small-size electrical products, such as fans, irons, heating utensils. In the five years since 1907, number of orders of Westinghouse Electric has increased 55.6 per cent, while the size of the individual order has dropped from $366 to $213, a shrinkage of 41.8 per cent.

Dividends.

Canadian General Electric Company; a quarterly common dividend of 1.75 per cent and an extra dividend of one per cent, both payable January 2 to stock of record December 15.

Chippewa Valley Railway, Light & Power Company; a quarterly preferred dividend of 1.75 per cent, payable December 1 to stock of record November 30.

Cleveland Railway Company; a quarterly dividend of 1.5 per cent, payable January 2 to stock of record November 30.

New England Telephone & Telegraph Company; a quarterly dividend of 1.75 per cent, payable December 31 to stock of record December 16.

Pensacola Electric Company; a semi-annual dividend of $3 per share, payable December 2 to stock of record November 20.

Portland Railway, Light & Power Company; an annual dividend of five per cent, payable December 1.

Brooklyn Rapid Transit Company; quarterly dividend of 1.25 per cent.

Reports of Earnings.

PHILADELPHIA RAPID TRANSIT.

The Philadelphia Rapid Transit Company reports as follows for October and four months ended October 31:

	1912.	1911.
October gross	$2,093,814	$1,947,003
October net	854,174	792,077
Surplus after charges..	95,053	55,058
Four months' gross....	7,851,893	7,498,160
Four months' net.....	3,182,907	2,944,687
Surplus after charges.	146,464	*3,502

*Deficit.

REPUBLIC RAILWAY & LIGHT.

The Republic Railway & Light Company reports as follows for September and twelve months ended September 30:

	1912.	1911.
September gross	$ 224,138	$ 202,495
Net after taxes	92,066	85,808
Surplus after charges..	48,154	41,384
Twelve months' gross.	2,561,435	2,345,855
Net after taxes	1,016,536	944,719
Surplus after charges..	487,414	421,573

KINGS COUNTY LIGHT.

The report of the Kings County Electric Light & Power Company for the ten months ended October 31, 1912, shows net earnings of $1,440,926, against $1,391,661 for the corresponding period in 1911. The income statement for October and ten months compares as follows:

October—	1912.	1911.
Gross	$ 427,016	$ 406,861
Net after taxes	130,017	150,500
Other income, debit..	312	*5,251
Total income	129,706	155,751
Surplus after charges..	57,470	83,516
Ten Months—		
Gross	4,194,531	3,803,238
Net after taxes	1,440,926	1,391,661
Other income	30,483	56,347
Total income	1,471,409	1,448,008
Surplus after charges..	749,052	767,441

*Credit.

UNITED LIGHT & RAILWAYS.

United Light & Railways reports for October, 1912, and the four months ended October 31, 1912, consolidated earnings of subsidiary companies as follows:

	1912.	1911.
October gross	$ 410,743	$ 369,803
October net	181,089	156,011
October surplus	100,847	76,321
Four months' gross...	1,576,011	1,431,117
Four months' net.....	690,437	603,439
Four months' surplus..	381,291	287,057

Earnings available for securities of United Light & Railways, for four months ended October 31, 1912, follow:

Gross	$422,263
Net	299,688
Dividend, first preferred	99,987
Dividends, second preferred	30,584
Balance	169,117
Total surplus to October 31, 1912..	281,556

BAHIA TRAMWAY.

The Bahia (Brazil) Tramway, Light & Power and the Compagnie D'Eclairage de Bahia report earnings for September, 1912, and the nine months ended September 30, 1912, as follows:

	1912.	1911.
September gross	£14,466	£13,050
September net	5,400	3,597
Nine months' gross	125,065	120,290
Nine months' net	42,331	36,626

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 25.	Nov. 18.
American Tel. & Tel. (New York)	142⅛	142¾
Commonwealth Edison (Chicago)	144	144
Edison Electric Illuminating (Boston)	283½	280
Electric Company of America (Philadelphia)	*12¼	*12¼
Electric Storage Battery common (Philadelphia)	55	54¾
Electric Storage Battery preferred (Philadelphia)	55	54¾
General Electric (New York)	183	181¾
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1⅛
Massachusetts Electric common (Boston)	18½	18½
Massachusetts Electric preferred (Boston)	76	77
National Carbon common (Chicago)	120	126
National Carbon preferred (Chicago)	117½	118½
New England Telephone (Boston)	154	153
Philadelphia Electric (Philadelphia)	23½	23⅞
Postal Telegraph and Cables common (New York)	84½	84
Postal Telegraph and Cables preferred (New York)	67½	67½
Western Union (New York)	79	78
Westinghouse common (New York)	81	81
Westinghouse preferred (New York)	*122	122

*Last price quoted.

PERSONAL MENTION.

THEODORE N. VAIL, president of the American Telephone & Telegraph Company, is recovering from a slight operation which he recently underwent.

WILLIAM MARCONI has left Venice, where he has been under the care of an oculist, and will stop for several weeks in London before coming to New York, where he is expected in January.

WILLIAM J. HISS, division general manager of the Western Division of the New York Telephone Company, has been appointed general manager of the Bell Telephone Company of Missouri, with headquarters at St. Louis.

F. M. CLIFFORD, who for some time has been manager of the Southwestern Telephone Company, Lockhart, Tex., has tendered his resignation to devote his entire time to the electrical business, which he has organized.

JAMES ROCHE, secretary of the Kentucky Water, Heating & Illuminating Company, of Lexington, Ky., has lost his wife, who died recently after a surgical operation at St. Joseph's Hospital.

CHARLES MUNSON, who for the past eight years has been superintendent of the Cedar Rapids & Iowa City Interurban Railway, has been appointed manager of the properties of the Iowa Railway & Light Company at Marshalltown, Ind.

MARSHALL B. DOWNING, Newark, N. J., district manager of the New York Telephone Company, has been promoted to the position of superintendent of traffic of the Missouri Bell Telephone Company, at St. Louis. J. W. Hubbell, Brooklyn, N. Y., will succeed Mr. Downing as district manager at Newark.

P. W. SOTHMAN, formerly chief engineer of the Hydro-Electric Power Commission of Ontario, has been engaged by Canadian capitalists to report on the construction of a 110,000-volt transmission line for a power company in Mexico. Mr. Sothman will return from Mexico by way of Utah and report on a 130,000-volt line to be built in that state.

A. T. MACDONALD, general sales manager of the Louisville Lighting Company, of Louisville, Ky., and one of the leading business men of that city, has recently been elected to membership in the Louisville Rotary Club. The Club is composed of a number of representatives of the professional and business world, only one man out of each line being admitted to the roster. As an expert central-station man, Mr. Macdonald is the only one in his line of business in the organization.

CHARLES F. HOWE, formerly of the Central Georgia Power Company, has entered the consulting engineering field in Macon, Ga. Mr. Howe has been actively engaged in water-power developments in the South for a number of years and has had considerable to do with the Central Georgia Power Company, the Macon Railway & Light Company, the Central Georgia Transmission Company and the Flint River Power Company, and has been retained as consulting engineer by all of these companies.

C. C. OUSLEY, a prominent newspaper man, has been appointed assistant to R. E. Hughes, president of the Kentucky Electric Company, Louisville, Ky. The office is a new one and was created especially for Mr. Ousley, whose work will be particularly along advertising lines. He is an expert in handling such campaigns, having handled the triennial conclave of the Knights Templar, the Knights of Pythias conclave and the Shriners' convention with great credit. Mr. Ousley was also press agent for Kentucky at the Jamestown Exposition.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following item should address the Bureau of Manufacturers, Washington, D. C., and refer to the file number noted.*)

NO. 9951. THERMOELECTRICAL PLANT.—The American consulate at Valparaiso, Chile, reports that the Chilean Government has asked for bids for the installation of a thermoelectrical plant at Valparaiso, suitable for the use of all public buildings in the port. Plans and specifications can be consulted in the Chilean Legation, Washington, D. C., and at the Consulate General at New York, N. Y., as soon as they are prepared and forwarded. Bids will be opened in the office of the Comision de Puertos, Santiago, Chile, September 10, 1913.

PROPOSALS.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until December 7, for furnishing labor and material required for placing lighting fixtures over driveway and mailing platform of the post office at Richmond, Va.

SWITCHES AND JUNCTION BOXES.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until December 2, for furnishing 125 iron junction boxes for target range, four master switches for 16 targets, and five master switches for 24 targets.

ELECTRIC FITTINGS.—Sealed proposals will be received at the office of the Bureau of Supplies and Accounts, Washington, D. C., until December 17, for 60 trolley blocks to be delivered at the Navy Yard, Washington, as per Schedule 5012, and 16 trolley insulators, frogs, etc., to be delivered at the same navy yard, as per Schedule 5011.

ELECTRIC CONDUITS AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until December 26 for furnishing electric conduits and wiring and interior lighting fixtures of a one-story building for the post office at Clarksville, Tex., in accordance with drawings and specifications, copies of which may be obtained from the office of the supervising architect.

NEW PUBLICATIONS.

BULLETIN OF THE EFFICIENCY SOCIETY.—The Efficiency Society has begun the publication of a monthly bulletin, which is published on paper free from glare and is of good typographical appearance. It will be devoted to furthering the objects of the Society. It is published at 29 West Thirty-ninth Street, New York City.

DENATURED ALCOHOL AS A FUEL.—The Bureau of Mines has issued bulletin No. 43 by R. M. Strong and Lauson Stone entitled "Comparative Fuel Values of Gasoline and Denatured Alcohol in Internal-Combustion Engines." This is a comprehensive report of 236 pages, including results of a large number of tests on the subject. The methods of procedure and the equipment used are described. Further researches relating to liquid fuels will be carried on. It is stated that denatured alcohol will not be used for power purposes to any great extent until its price is as low as gasoline.

ILLUMINATION PRIMER.—A second edition of "Light: Its Use and Misuse," a primer on light and illumination published by the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York City, has been issued. Written in a clear and comprehensive manner for popular reading, this little pamphlet has met with immediate favor. It has occasioned considerable complimentary criticism from people who are generally supposed to have little or no interest in the subject of lighting. From the heads of engineering and physics departments of schools and colleges the Society has received numerous letters of commendation, together with requests for quantities of the primer for distribution to students. Architects, engineers, oculists, merchants, and others have also expressed their appreciation of the publication. Several lighting companies are planning to issue it to their customers. One large manufacturing company in London has cabled for permission to print and distribute a large edition in Europe. It is not unlikely that the primer will go into many editions.

NEW INCORPORATIONS.

DETROIT, MICH.—J. W. McNair Electric Company has been incorporated with a capital stock of $15,000.

CLEVELAND, O.—The Hale-Christy Company has been incorporated with a capital stock of $3,000 to manufacture and deal in electrical and mechanical devices.

CHICAGO, ILL.—Electric Vehicle Battery Company has been incorporated with a capital stock of $2,000 to engage in the manufacturing business. Elbert C. Ferguson, Guy L. Eames and Ella A. O'Neill are the incorporators.

BLUFFTON, IND.—A. L. Lewis Company has been incorporated with a capital stock of $10,000, to manufacture and sell toys and light fixtures. The incorporators are A. L. Lewis, George A. Lewis and T. L. Prall.

CHICAGO, ILL.—The Chicago Central Station Institute has been incorporated with a capital stock of $10,000 to operate a school for instruction in electricity. The incorporators are B. A. O'Connor, Kenneth B. Hawkins and Edwin H. Cassels. Z.

DAYTON, O.—The Peerless Electric Sign Company has been incorporated with a capital stock of $50,000 to deal in advertising devices. The incorporators are W. W. Arnold,

Frank W. Howell, John A. McGee, Ellis J. Finke and George Baker.

CLEVELAND, O.—The Eastern Electric Company has been incorporated with a capital stock of $10,000 to do a general electrical business. The incorporators are Charles Q. Nelson, Charles P. Salen, Mamie A. Salen, Hermon Arstin and Helena Smith.

ANDERSON, IND.—The Diamond Gas & Electric Engineering Company has been incorporated with a capital stock of $50,000. The company will do designing and construct gas plants and plants for generating electricity. I. N. Stillwell, L. J. Diamond and H. C. Stillwell are directors. S.

NEW YORK, N. Y.—Nimis & Nimis, Incorporated, has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing machinery, dynamos and electrical and mechanical appliances. Albert A. Nimis, Joseph P. Smith and Wendell P. Barker, all of New York, are the incorporators.

CROWN POINT, IND.—Northern Public Service Company of Indiana has been incorporated with a capital stock of $100,000 to engage in an interurban and electric business. The directors of the company are William R. Watson, Charles J. Ruebling and L. Ota Hikes.

HARTFORD, CONN.—The Cohn & Roth Electric Company has been granted papers of incorporation. The capital stock of the company is $10,000 and the purpose is to manufacture all kinds of gas and electrical supplies. A. Cohn, J. Fred Roth and William L. Meyer are the incorporators.

FENNSBORO, W. VA.—Electric Undercurrent Company has been incorporated with a capital stock of $1,000,000 to manufacture electrical apparatus. The incorporators are H. L. Lambert, H. J. Scott, C. R. Cunningham, J. G. Young, G. P. Fought, E. Z. Weekly, all of this city.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York, N. Y., December 3-6.

American Institute of Chemical Engineers. Annual meeting, Detroit, Mich., December 4-6.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

Northwestern Cedarmen's Association. Annual meeting, Duluth, Minn., January 7-8, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

With the Electrical Manufacturers

Thatcher T. P. Luguer, consulting engineer, has removed his office to 15 East Fortieth Street, New York City.

S. R. Fralick & Company, Chicago, has removed its main office and warehouse to 15 and 17 South Clinton Street. This company acts as sales agent for a great variety of electrical supplies and specialties and its new quarters will give increased facilities for promptly handling all this class of business.

Hart & Company, Fostoria, Ohio, has issued a leaflet calling attention to its Langleben self-lubricating carbon brushes. These are made in a great variety of forms adapted to all kinds and types of commutating machines. Bronze woven wire-gauze brushes and Red Cross commutator lubricant are also made by the company.

National Tube Company, Pittsburgh, Pa., in its bulletin No. 11 describes the Spellerizing process, which is a mechanical method of treating the metal so as to better adapt it to resist corrosion. This process is applied to the smaller size of pipe up to 4 inches in diameter. Every piece of the company's pipe has the word "National" rolled upon it in raised letters.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. has placed on the market a very convenient and compact telephone outfit called the Deffone. As suggested by this name this device is a complete telephone set to aid the majority of deaf people. The set is light in weight, small in size, and entirely dependable. It is manufactured under the supervision of Miller Reese Hutchinson, chief engineer and personal representative of Thomas A. Edison.

The Green Fuel Economizer Company, Matteawan, N. Y., has issued a 48-page book entitled "What We Make." It describes and illustrates fuel economizers, both standard and special, coverings for fuel economizers, mechanical-draft outfits, heating, ventilating and drying outfits, hot-blast heaters, steel-plate fans, motor and engine-driven fans, cast-iron volume blowers, slow-speed and standard-speed planing-mill exhausters, fan and cone wheels, wool wheels, ventilator wheels, propeller fans, vertical and horizontal engines and mechanical-draft dampers.

The Remington Oil Engine Company, Stamford, Conn., has issued several new bulletins describing its line of oil engines. Bulletin 8-C-12 is devoted to electric generating sets, consisting of a Remington oil engine and a direct-connected generator; these are made in sizes from 3 to 36 kilowatts. Bulletin 9-E-12 calls attention to several types of Remington marine oil engines, as well as stationary engines, direct-connected pumping, hoisting, air-compressing and generating sets. Bulletin 11-D-12 describes the 50-horsepower Remington marine oil engine, complete with stern paddle wheel, reverse gear and transmission.

Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1628 which describes hydraulic turbines of the horizontal, single, double, triple and quadruple-runner, open-flume types. The runners for these turbines are of two types, known as E and F. The bulletin describes and illustrates the special constructural features of these machines, gives efficiency and characteristics of the runners and includes very complete power and speed tables for 25-cycle and 60-cycle machines. Mention is also made in the bulletin of the efficient design of draft tubes, oil-pressure governors and other accessories to a hydroelectric installation.

H. W. Johns-Manville Company, New York City, has isued a bulletin calling attention to the virtues of its J-M Success liquid chemical fire-extinguishers. These are of improved construction and embody distinctive features that well merit the name "Success" chosen for this device. The company also makes a chemical fire engine of easily movable and effective design. The Manville dry power chemical fire-extinguisher, also manufactured by the company, is a compact form of extinguisher adapted to many places where the liquid type would not be quite so suitable.

Crocker-Wheeler Company, Ampere, N. J., has issued two new bulletins Nos. 150 and 158. The first of these is devoted to direct coupled and belted types of alternating-current generators. These are made for two-phase and three-phase service and in sizes from 50 kilowatts upwards. Bulletin No. 158 describes adjustable-speed direct-current motors, involving speed ranges up to 3 to 1. The motors are made in sizes from one-third to 32 horsepower. Two forms of the motors are manufactured, the form L being of the inclosed type and form I F of the open type. Both of these bulletins are completely illustrated with part of the machines and assembled units and give detailed descriptions of their construction.

The Griscom-Russell Company, 90 West Street, New York City, sole representative of Hughes & Sterling, destructor specialists, has published a handsome book describing the Sterling destructor. The destructors of the Sterling type are having wide application abroad, and in this country there appears to be a great opportunity for the use of an apparatus of this character. The old, unsanitary methods of

refuse disposal have proved so objectionable that municipalities everywhere are welcoming these more modern and economical ways of handling wastes. The Sterling destructor has met with marked success in practical use, and central stations and municipalities interested in a study of this subject should be in possession of the book, which may be secured by application to the Griscom-Russell Company.

Peerless Insulated Wire & Cable Company, has been incorporated under the laws of the State of Delaware with a capital stock of $1,000,000. This is divided into $250,000 of seven-per-cent preferred cumulative stock and $750,000 of common stock. The officers and directors are: William E. Cook, president; W. J. Leddell, vice-president; I. V. Weisbrod, secretary and treasurer; Franklin S. Randall and H. W. Davis. The main office of the company is at 18 Broadway, New York City, and the factory is located at Pennington, N. J. The company has been organized for the purpose of manufacturing and dealing in all grades of insulated wires and cables and more especially those produced under the Randall patents. These cover special machinery which enables the company to use unspun cotton fiber for insulating purposes; this process permits the company to manufacture a superior grade of insulated wires at a considerable reduction in cost as compared with other methods. The wire has been approved by the Underwriters' Laboratories.

General Electric Company, Schenectady, N. Y., states that among recent orders for electrical equipment are the following: Apollo Steel Company, Apollo, Pa., for one 1,400, six 10, five 30-horsepower, horizontal motors, two 10-horsepower vertical motors, and switchboard; Carnegie Steel Company, Pittsburgh, Pa., a 3,000-kilowatt Curtis condensing turbogenerator with a 35-kilowatt noncondensing turbo-exciter and switchboard apparatus; Chase Rolling Mill Company, Waterbury, Conn., a 750-kilowatt Curtis turbogenerator with 35-kilowatt exciter and two direct generators of 25 and 50 kilowatt capacity; Yuba Construction Company, Marysville, Cal., nine motors ranging from 2 to 400 horsepower, three 200-kilowatt and one 15-kilowatt transformers and switchboard for the dredge *Yuba No. 14*; General Chemical Company, New York, N. Y., two 625-kilowatt Curtis turbogenerators with 15-kilowatt turbo-exciter and 14-kilowatt motor-generator exciter set, a 50-kilowatt motor-generator, 20 motors ranging from 5 to 75 horsepower, and switchboard apparatus; Rhinehart & Dennis Company, Dante, Va., two 300-horsepower, alternating-current motors, two 100-kilowatt generator sets, six 125-kilowatt transformers and a switchboard; Great Western Power Company, San Francisco, Cal., a 5,000-kilowatt transformer, six 200 and six 300-kilowatt transformers; East Creek Electric Light & Power Company, Inghams Mills, N. Y., a 2,200-kilowatt frequency-changer set, a 25-kilowatt motor-generator set, three 1,250-kilowatt transformers and a switchboard; C. D. Parker & Company, Palmer, Mass., four 30-kilowatt, nine 100, three 300 and three 1,000-kilowatt transformers, also considerable switchboard material.

Record of Electrical Patents.

Issued by the United States Patent Office, November 19, 1912.

1,044,480. Sanitary Shield for Telephone Transmitters. R. W. Bogart, Jr., New York, N. Y. Has rollers between which paper is stretched across the mouthpiece.

1,044,490. Animal Trap. J. B. Cessna, Pittsburgh, Pa. Includes electrocution platforms.

1,044,502. Method and Apparatus for Detecting and Observing Forces. A. C. Crehore, Yonkers, N. Y., and G. O. Squier, Washington, D. C. The forces are applied to plates illuminated by an electric mercury-vapor lamp.

1,044,507. Electric Switch Mechanism. E. Edwards and G. W. Briggs, Rigby, Idaho. Includes a rotary contact closer that intermittently engages lamp-circuit terminals.

1,044,521.—Service Entrance Fitting.

1,044,509. Sparking Plug. F. Wm. Erickson, New York, N. Y. Relates to details of construction.

1,044,521. Conduit Fitting. M. Havens, Jr., Albany, N. Y. A service entrance terminal with a rounded dome below whose flanges the wires enter.

1,044,528. Spark Plug. E. F. Hopkins, Chicago, Ill. Includes a reciprocating central electrode.

1,044,538. Selective Apparatus for Party Telephones. D. W. Kneisly, assignor to Dayton Telephone Lockout Manufacturing Co., Dayton, O. A special switch controls the impulse-transmitting mechanism.

1,044,549. Electric Battery. W. H. Lowe, assignor to Float Electric Co., Ltd., New Kent Road, England. A reversible cell with lead cover, carbon and zinc electrodes.

1,044,562. Electrical Resistance. C. A. Mudge, assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. An alloy containing 4.2 per cent carbon, 2.5 per cent aluminum, 2.4 per cent silicon, 90.0 per cent iron.

1,044,568. Lamp Guard. F. Overbagh and I. H. Brent, assignors to Overbagh & Ayers Manufacturing Co., Chicago, Ill. A wire cage with split clamping ring.

1,044,595. Contact Shoe. F. A. Stuhlfeier, Chicago, Ill. For third-rail use, has teeth on the contact surface.

1,044,597. Calculating Mechanism for Typewriters. H. Sugden and C. F. Pidgin, assignors to National Cash Register Co., Dayton, O. Includes electric counting circuits and electromagnetic control for the printing.

1,044,609. Means for Controlling Electric Motors. J. T. Watson, Copperhill, Tenn., assignor of one-half to B. G. Slaughter, Jr. The individual motors for a series of machines are all stopped when one particular one is accidentally stopped.

1,044,637. Method of Receiving Electromagnetic Waves. R. A. Fessenden, assignor to National Electric Signaling Co., Pittsburgh, Pa. Consists in varying the value of friction between two relatively moving electrodes and operating an indicator through such change.

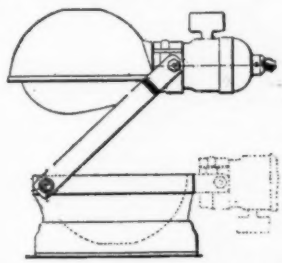
1,044,640. Dynamo-Electric Machine. V. A. Fynn, London, Eng. Has shunt, series and neutralizing stator windings; the two latter are in series with the rotor when the machine runs as a motor; when this machine runs as a converter they are short-circuited and only the shunt is connected.

1,044,641. Rotary Converter. V. A. Fynn, London, Eng. The rotor has a commuted winding and a separate winding covering only part of its surface; phase-displacing windings are connected between the source and slip rings.

1,044,653. Apparatus for Sterilizing Water. S. Held, Chicago, Ill. An electric ozonizing outfit is connected to a faucet.

1,044,656. Process of Coating Tin-Foil and The Resulting Product. A. J. Howell, Syracuse, N. Y. Melted paraffin is coated on the foil under pressure to adapt it for use in condensers.

1,044,658. Light for Gun-Sights. W. A. Ide, Centralia, Wash. Has electric lamps at the forward and rear sights.



1,044,689.—Collapsible Lamp Stand.

1,044,689. Electric-Light Stand or Support. J. F. Pierce, Tampa, Fla. Two arms are pivoted to the base and to a socket-holding clamp; when collapsed the arms span the base and the reflector forms a cover over it or fits within it.

1,044,700. Ozonizer. R. D. Small and O. Linder, assignors, to Vohr Ozone Electric Co., Chicago, Ill. Consists of pairs of cylindrical electrodes.

1,044,717. Binding-Post. P. E. Wiberg, Glen Ridge, N. J. The clamping member has several grooves for wires of different diameter.

1,044,747 and 1,044,748. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Relates to special connection of the supervisory and line relays on the exchange switchboard.

1,044,751. Electrical Agricultural

System. C. S. Doney, assignor to Doney Electrical Agricultural System, Columbia Falls, Mont. An electrically driven plow or other portable machine is connected by trolleys to a network of overhead conductors.

1,044,772. Lamp Bracket. B. G. Gilbough, assignor to Metal Specialties Manufacturing Co., Chicago, Ill. An electric-lamp socket may be held upright or in horizontal position.

1,044,785. Wire Guard for Electric Lamps. C. H. Hunsberger, North Tonawanda, N. Y. Has a special locking device for fastening the cage to the lamp socket.

1,044,798. Wireless-Telephone Transmitter. J. P. McCarthy, K. Douglas, and F. P. Herrguth, assignors to Universal Wireless Telephone & Telegraph Co., San Francisco, Cal. A transformer with spark gap is connected across a Wheatstone bridge of which the transmitter forms one arm.

1,044,819. Electric Railway. W. B. Purvis, Sharon Hill, and A. D. W. Gritman, Philadelphia, Pa. A sectional third-rail system.

1,044,825. Double-Ended Electric Lamp. B. Settecase, Louisville, Ky. Has a loop of the filament in each end of the bulb and connected to double pole rings around the middle.

1,044,827. Means to Control Magnetic Circulation in Electric-Current-Producing Devices. E. F. Smith, assignor to Smith Electric Tool Co., Cincinnati, O. The rotor of the motor is eccentrically mounted with respect to the field frame and the yoke is adjustable.

1,044,831. Storage-Battery Grid. E. F. Wackwitz, assignor to Peerless Motor Car Co., Cleveland, O. Has diagonal ribs radiating from the terminal lug and curved ribs tangential to these.

1,044,835. Recording Device. C. B. Wattles, Providence, R. I. In an opening in one side of a chimney is an electric lamp; in an opposite opening is a sensitized clock-controlled smoke recorder.

1,044,852. Support or Holder for Incandescent Electric Lights. H. E. Beisler, assignor to McGill Manufacturing Co., Valparaiso, Ind. A handle through which the wires pass carries a lamp socket and switch.

1,044,865. Telephone-Exchange System. W. W. Dean, assignor to Dean Electric Co., Elyria, O. Relates to the line and cut-off relays.

1,044,870. Guy-Wire Anchor. C. D. Enochs, La Crosse, Wis., assignor to Vote-Berger Co. Is first driven into the ground and then twisted, thus opening retaining screw blades.

1,044,885. Connector. W. P. Hammond, Passaic, N. J. Has reversely bent and perforated spring arms that engage a binding-post.

1,044,899. Wire-Straightener. G. S. McLean, Waterbury, Conn. A rotatable frame carries a central die-holder.

1,044,901. Steering Indicator. F. B. Mills, Chicago, Ill. An electric lamp signal.

1,044,922. Primary Battery. C. B. Schoenmehl, Waterbury, Conn. Has a cylindrical copper-oxide electrode with special support therefor.

1,044,923. Cord Terminal. C. B. Schoenmehl, Waterbury, Conn. A sheet-metal tip is secured to the wire-terminal eye.

1,044,927. Electrical Resistance Furnace. O. Serpek, assignor to Société Generale des Nitrures, Paris, France. Has a refractory lining supporting resistance elements shaped to form stirrers.

1,044,928. Revolving Electrical Furnace with Resistances Arranged Diametrically. O. Serpek, assignor to Société Generale des Nitrures. Has external contact rings connected to the resistances.

1,044,944. Pulley Brake for Motor-Controlled Apparatus. M. Taigman, New York, N. Y. Movement of the switch arm actuates the brake on a sewing machine.

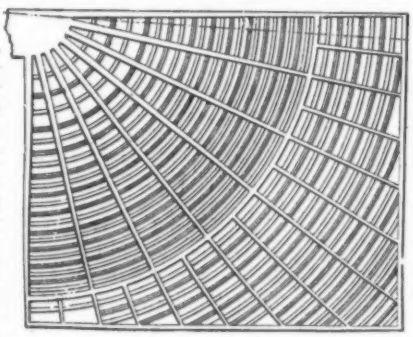
1,044,950. Apparatus for Electric Lighting. W. D. Uptegraff, Pittsburgh, Pa. A Nernst lamp has an incandescent lamp in its heater circuit which is cut out when the glower becomes incandescent.

1,044,957. Electric Furnace for Producing Oxids of Phosphorus from Natural Phosphates. F. S. Washburn, Nashville, Tenn. The electrodes are inwardly inclined and pass through granular carbon packing.

1,044,965. Automatic Weighing Device. T. Zollner, Duluth, Minn. Movement of the scales closes the circuit for an electromagnet which controls a clutch and gate for the screw conveyor that feeds materials.

1,044,978. Trolley. A. F. Bevard, Carnegie, Pa., assignor of one-half to P. McDermott. Has a flexible connection between the harp and pole.

1,044,981. Combined Telegraph and Telephone System. C. L. Bopp, Hawkeye, Ia. Includes condensers and inductances to separate the line currents at the stations.



1,044,831.—Storage-Battery Grid.

1,044,984. Electromagnetic Reversing Gear. B. Brukwicki, Rakowo, near Niehof, Germany. A magnetic clutch and speed-changing device.

1,045,034. Telephony. M. L. Johnson, assignor to Corwin Telephone Manufacturing Co., Chicago, Ill. A pilot lamp is provided for each group of line-signal lamps.

1,045,043. Block-Signal System. W. A. Lacke, Chicago, Ill. The semaphores are electromagnetically controlled.

1,045,051. Refillable Cartridge Fuse. E. B. Mallory, assignor to Economy Fuse & Manufacturing Co., Pittsburgh, Pa. A replaceable fuse of special section for each size is held between end washers by removable caps.

1,045,077. Telephone Signaling Appartus. F. D. Powell, assignor to American Coin Register Co., Chicago, Ill. The insertion of coins at a pay station is electrically signaled to the exchange operator.

1,045,084. Chandelier. A. Sechrist, assignor to Albert Sechrist Manufacturing Co., Denver, Colo. A tube connector and spacing sleeves for joining radial arms to the electrolier stem.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 26, 1912.

550,242. Electric Car-Lighting Apparatus. W. Biddle, Brooklyn, N. Y.

550,255. Apparatus for Hanging and Cleaning Telegraph or Telephone Wires. A. Custodis, Dusseldorf, Germany.

550,260. Telephone-Circuit Signal. M. A. Edson, Chicago, Ill.

550,281. Tube, Pipe, or Conduit. R. H. Martin, Brooklyn, N. Y.

550,283. Electric Mining Machine. E. C. Morgan, Chicago, Ill.

550,298. Electrically Controlled Clutch Mechanism. J. E. Stannard, Springfield, Mass.

550,319. Electric Tramway With Underground Distribution of Current. A. Diatto, Turin, Italy.

550,329. Electrical Pumping Apparatus. G. Rennerfelt, Arvika, Sweden.

550,330. Electric Pumping Apparatus. T. G. Rennerfelt, New York, N. Y.

550,344. Electrolocomotive. J. J. Heilmann, Paris, France.

550,354. Self-Exciting Constant-Current Alternator. A. Schmid and B. G. Lamme, Pittsburgh, Pa.

550,355. System of Electrical Distribution. O. B. Shallenberger, Rochester, Pa.

550,360. Non-Welding Contact. A. J. Wurts, Pittsburgh, Pa.

550,365. Electric Arc Lamp. Frank Emery, New York, N. Y.

550,393. Electric-Car Truck. L. J. Hirt, Somerville, Mass.

550,403. Electrodepositing Apparatus. H. L. Bridgman, Blue Island, Ill.

550,411. Electric Switch. T. Harper, New Brunswick, N. J.

550,432. Electric-Lighting Gas Burner. J. M. Anck, Philadelphia, Pa.

550,437. Electric Railway. D. Brooks, Jr., Philadelphia, Pa.

550,464. Dynamo-Electric Machine. E. Thomson and M. J. Wightman, Lynn, Mass.

550,465. Electric Railway. G. Westinghouse, Jr., Pittsburgh, Pa.

550,467. Electric and Fluid Locomotor. G. Westinghouse, Jr., Pittsburgh, Pa.

550,468. Ventilating Means for Electrical Apparatus. G. Westinghouse, Jr., Pittsburgh, Pa.

550,469 Apparatus for Lighting Miners' Safety Lamps. W. Ackroyd, Birkenshaw, and W. Best, Morley, England.

550,480. Plate for Secondary Voltaic Batteries. W. A. B. Buckland, London, Eng.

550,481. Controlling Apparatus for Electromoters. J. B. G. A. Canet and A. Hillairet, Paris, France.

550,484. Electric Regulator. G. W. Colles, Jr., Hoboken, N. J.

550,510 and 550,511. Telegraphy. I. Kitsee, Philadelphia, Pa.

550,533. Well for Batteries. J. Schreuder, Edgewood, Pa.

550,534. Battery Well. J. Schreuder, Edgewood, and S. H. Stupakoff, Pittsburgh, Pa.

550,535. Railway Signal. J. Schreuder, Edgewood, Pa.

550,566. Track Instrument for Electrically Controlled Railroad Signals. C. H. Sherwood, Utica, N. Y.